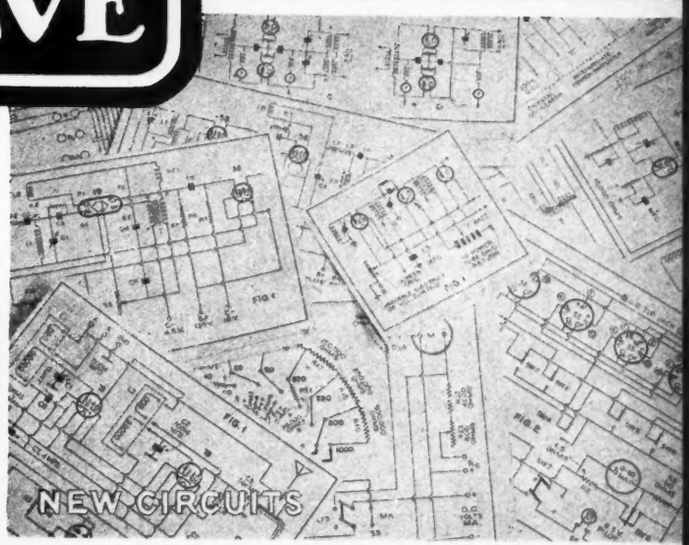
SHORT-WAVE STATION LIST

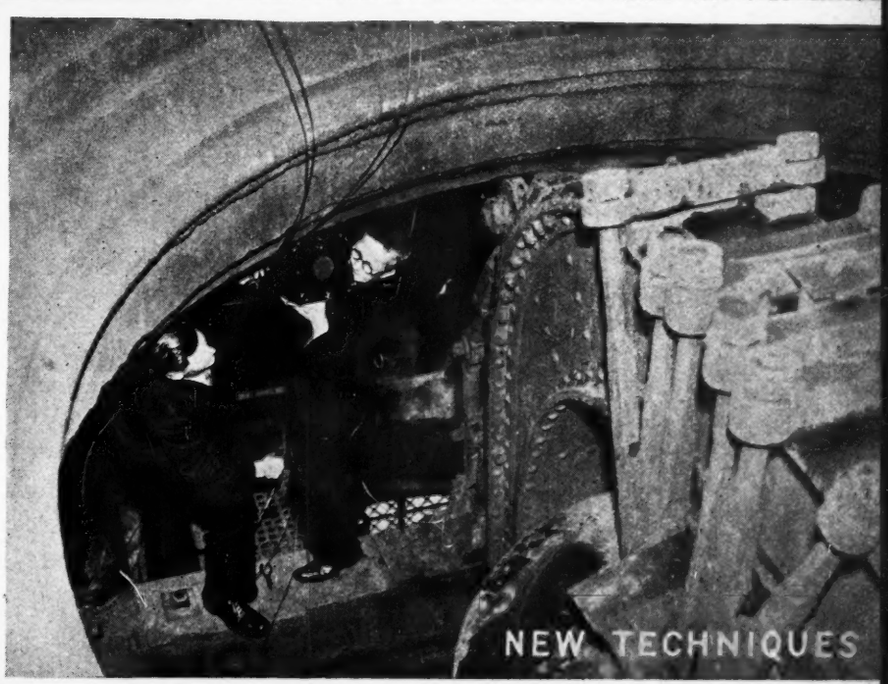
RADIO NEWS and The SHORT-WAVE

RADIO PICTURES



NEW CIRCUITS

BIG NEW THINGS in RADIO

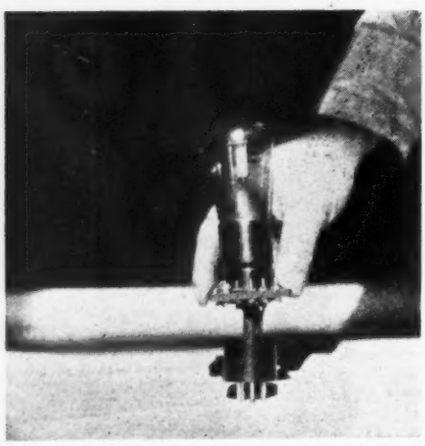


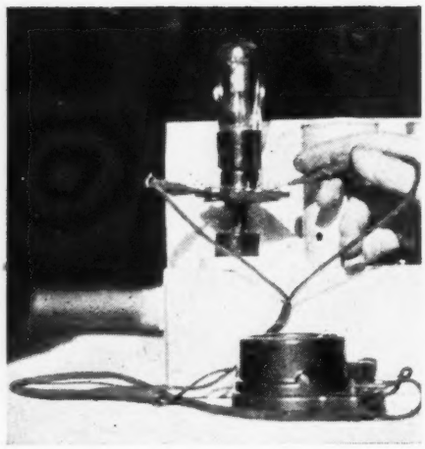
NEW TECHNIQUES

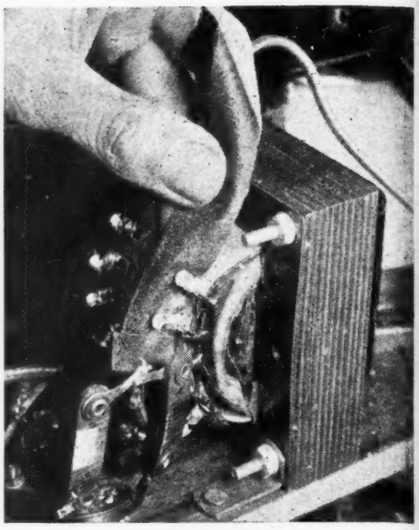
NEW RESEARCHES

A Publication Devoted to Progress in Radio

Service Work	Short Waves	DX Reception
Engineering	Broadcasting	Set Building
Research	Television	Amateur Activity
Applications	Electronics	Measurements







At Your Fingertips!

Right at your fingertips! Accurate, complete reports of all of the important, current happenings in the field of radio . . . new circuits . . . new servicing equipment . . . new hints and kinks that save time and money . . . widely recognized radio courses . . . up-to-the-minute station lists . . . world short-wave time-tables . . . that's what RADIO NEWS brings to its readers every month of the year . . . that's why thousands of radio men read and use RADIO NEWS every month!

Keep Apace With Radio

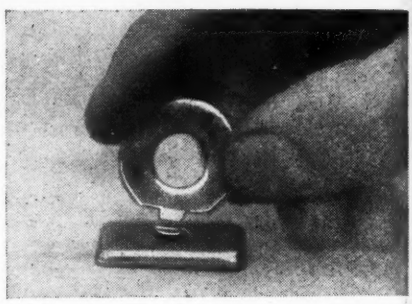
Surely YOU want to keep well-informed as the radio pageant moves on! Right at this very moment a multitude of new circuits, new ideas, new servicing data, new hints and kinks and many other important developments are springing up at a faster pace than ever before. RADIO NEWS is bound to prove its worth to you many times over during the coming months. Make sure you get a copy—every month!

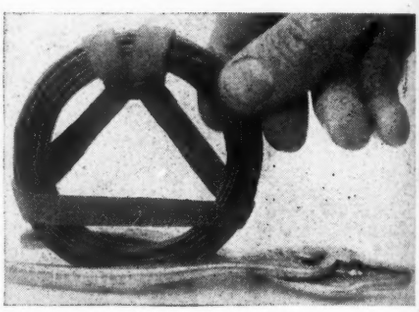
The Radio Experimenters' Handbook

The 136-page Radio Experimenters' Handbook will bring to your fingertips a wealth of practical information and technical data on electrical measurements—resistance, inductance and capacity measurements—measuring apparatus—radio component design—circuit design—short-wave radio principles—ultra-short-wave essentials—photo-electric cell equipment and applications—experimental television data—laboratory and shop notes—antenna notes and experiments—experimental circuits in radio and electronics—and over 150 important diagrams, charts and illustrations. By subscribing for RADIO NEWS you can get this valuable book absolutely free.

Mail the coupon with your remittance of $1 today. It will probably prove to be the best investment you ever made! And, show this copy of RADIO NEWS to your friends. They'll probably want to subscribe too!

Radio News





SPECIAL SUBSCRIPTION OFFER

Assure yourself of the prompt receipt of the next five issues of RADIO NEWS by subscribing at the special rate of $1. (Canada & Foreign $1.50.) In addition to RADIO NEWS, we will send you, absolutely free, a copy of the Radio Experimenters' Handbook, described to the left. Mail the coupon today!

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Enclosed find $1. Send me RADIO NEWS for the next 5 months and forward a free copy of the Radio Experimenters' Handbook at once. (Canada & Foreign $1.50.)

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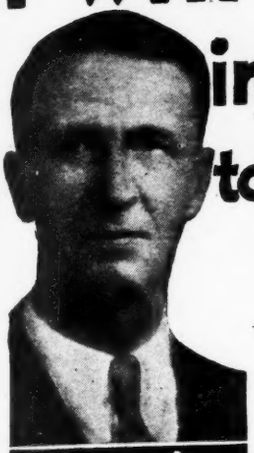
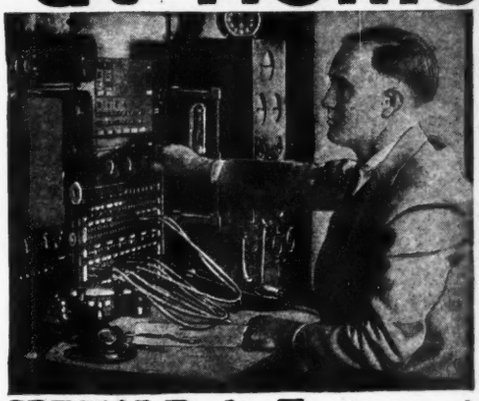
I will Train You at Home in your spare time to fill a GOOD JOB in Radio



Here's Proof

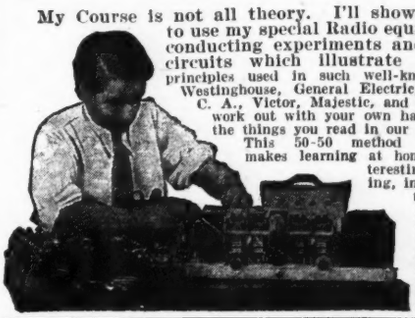


SPECIAL Radio Equipment for Broad Practical Experience *Given Without Extra Charge*

Get away from disagreeable jobs with no future. From skinny, little pay envelopes. From skimping along, just barely getting by, but not getting ahead. DON'T PUT UP WITH THEM ANY LONGER. Get into a field with a future. Act today to put yourself ahead. Mail the coupon for my free 64-page book, that tells how you can train at home in your spare time to be a Radio Expert; about my Course that doubles and triples the pay of many who take it. MAIL THAT COUPON NOW and take the first step toward a real future.

Free Book Tells How Mail Coupon!

My Course is not all theory. I'll show you how to use my special Radio equipment for conducting experiments and building circuits which illustrate important principles used in such well-known sets as Westinghouse, General Electric, Philco, R. C. A., Victor, Majestic, and others. You work out with your own hands many of the things you read in our lesson books. This 50-50 method of training makes learning at home easy, interesting, fascinating, intensely practical. You learn how sets work, why they work and how to make them work when they are out of order.



Service Manager Earns $200 Month.

"As Radio Service Manager for Sterchi's four Nashville Stores, my earnings are around $200 a month. My N.R.I. training enables me to keep our customers satisfied."
E. H. Leftwich
Sterchi Bros. Stores, Inc.,
Nashville, Tenn.

$120 a Month In Spare Time

"I'm servicing from 3 to 5 sets daily in spare time and average $120 a month from my Radio work. I still hold my regular day job. I owe my success to N.R.I."
A. E. Farmer
1012 Denison St.
Muskogee, Okla.

Owes a Lot to N. R. I.

"After finishing my tenth lesson, I started on my first job. After that, jobs came rolling in and I found myself with a surplus of money with which to continue paying for my Course. My first year's record was 108 Radio jobs. I have cleared $2,305 to date in spare time."
John Hearl
66-53 Jary Ave.
Maspeth, L. I., N. Y.

Real Opportunities Ahead in Radio for Trained Men

It's hard to find a field with more opportunity awaiting the trained man. Why in 1933—one of the worst depression years—the Radio Industry sold $213,000,000 worth of sets and parts! Radio set sales increased 45%—tube sales increased 25%! Over 300,000 people worked in the industry. It's a gigantic business, even in the worst business years! And look what's ahead! Millions of sets becoming obsolete annually. 16,000,000 sets are in operation on which over $200,000,000 are spent each year for repairs, servicing, new tubes, etc. Broadcasting stations pay their employees (exclusive of artists) approximately $23,000,000 a year. Advertisers pay 600 great broadcasting stations over $75,000,000 a year for radio time and talent. These figures are so big that they are hard to grasp! Yet, they are all true! Here is a new industry that has grown into a commercial giant. No wonder great business leaders predict a brilliant future for this great and growing business.

Get Into This Field With a Future

There's opportunity for you in Radio. Its future is certain. Television, short wave, police Radio, automobile Radio, loud speaker systems, aircraft Radio—in every branch, developments and improvements are taking place. Here is a real future for thousands and thousands of men who really know Radio. Get the training that opens the road to good pay and success! Send me the coupon now, and get full particulars on how easy and interesting I make learning at home. Read the letters from graduates who are today earning real money in this fascinating industry.

Many Make $5, $10, $15 a Week Extra in Spare Time Almost at Once

My book also tells how many of my students made $5, $10, $15 a week extra in spare time, soon after they enrolled. I give you plans and ideas that have made good spare time money—$200 to $1,000 a year—for hundreds of fellows. My Course is famous as "the one that pays for itself."

Money Back if Not Satisfied

I am so sure that N.R.I. can train you satisfactorily that I will agree in writing to refund every penny of your tuition if you are not satisfied with my Lesson and Instruction Service upon completion. You'll get a copy of this Agreement with my book.

64-Page Book of Information Free

Get your copy today. It's free to any ambitious fellow over 15 years old. It tells you about Radio's spare time and full time job opportunities; it tells you all about my Course; what others who have taken it are doing and making. Find out what Radio offers YOU without the slightest obligation. MAIL THE COUPON in an envelope, or paste it on a 1c post card NOW.

J. E. SMITH, President
National Radio Institute, Dept. 4-HR
Washington, D. C.

FREE: Radio Servicing Tips

Let me PROVE that my Course is clear, easy to understand and fascinating to study. Send the coupon for a free lesson, "Trouble Shooting in D.C., A.C., and Battery Sets." This interesting lesson gives 132 ways to correct common Radio troubles. I am willing to send this book to prove that you too can master Radio—just as thousands of other fellows have done. Many of them, without even a grammar school education, and no Radio or technical experience, have become Radio experts and now earn two or three times their former pay. Mail the coupon now.

I have doubled and tripled the salaries of many. Find out about this tested way to BIGGER PAY

Get a Job with a Future

FILL OUT AND MAIL THIS COUPON TODAY

J. E. SMITH, President
National Radio Institute, Dept. 4HR
Washington, D. C.

Dear Mr. Smith, I want to take advantage of your Special Offer. Send me your manual "Trouble Shooting in D.C., A.C. and Battery Sets" and your book "Rich Rewards in Radio," which explains Radio's Opportunities for bigger pay and your method of training men at home in spare time. I understand this request does not obligate me. (Please print plainly.)

Name.....*Age*...
Address.....
City.....*State*.... M

The Famous Course That Pays For Itself

Vol. XVI
No. 2

RADIO NEWS

August, 1934

Edited by LAURENCE M. COCKADAY

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THIS MONTH—

What's New

Electronics

Short Waves

Radio Studies

All-Wave Sets

NEXT MONTH—

For Short-Wave and DX Fans: The DX Corners bring you World Time Schedules and Notes on Receiving Far-Off Transmissions and a World Distance Chart for Europe.

For Servicemen: RADIO NEWS Service Instruments Explained and Constructed. Service Notes and News.

This issue will also contain articles on Latest Developments, articles for the Beginner in Radio and articles for the Engineering Profession.

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Ray D Smith

AN OPPORTUNITY TOO GOOD TO MISS

Many R-T-I Trained Men EARN $35 TO $75 A WEEK

If you're dissatisfied with small pay — work that's getting you nowhere — lay-offs and uncertain income — here's an opportunity that's too good to miss. At the cost of only the time it takes you to mail the coupon, you can get my big FREE book, **"Radio's Future and Yours."** This book tells how you can learn at home to make more money almost at once in Radio — whether you want to make Radio your life's work, or use it to pick up an extra $5 to $20 a week in your spare time.

"RADIO'S GROWING BY LEAPS AND BOUNDS"

says *Radio Craft Magazine*. It has forged ahead even in depression years. Where only a few hundred men were employed a short time ago, thousands are employed today. Where a few years ago a hundred jobs paid $35 to $75 a week—there are thousands of such jobs today. And more new jobs being created all the time—*full time and spare time jobs*. Get my book and see how easy it is to learn at home for this good-pay work.

R-T-I TRAINING IS "SHOP TRAINING" FOR THE HOME

It comes to you right from the Radio Industry—right out of the factories where Radio sets and other vacuum-tube devices are made. It was planned and prepared for you by big radio engineers IN these factories, most of whom are the Chief Engineers of these great Radio plants. *And NOW these same engineers are actually supervising* R-T-I Training. Which means that trained the R-T-I way, you'll be trained as the Radio Industry wants you trained—just as the Radio Industry, itself, would train you if it was doing the job.

SOUND PICTURES, P. A. SYSTEMS, PHOTO CELLS, TELEVISION, ETC. ALL INCLUDED

Radio service work is just the starting point in R-T-I Training. From there we take you up through the very latest developments in Radio, and then on into the new and larger field of Electronics —Sound Pictures, Public Address Systems, Photo Cells, and Television. This feature alone makes R-T-I the outstanding home training in Radio.

YOU GET "QUICK RESULTS"

C. E. Head, 431 Third Street, Alexandria, La., says: "Made my first money 11 days after starting your training—cleared $14.25."

Frank E. Kleman, Lisle, Ill., writes: "Doubled my pay in less than six months."

Harry L. Stark, Ft. Wayne, Ind., writes: "Now making three times as much money as I was when I started your training."

AGE OR LACK OF EDUCATION NO HANDICAP

You don't have to be a high school graduate. It isn't necessary that you should have finished the grades. My Training in Radio is so simple, so easy and so practical, that it offers every man regardless of age, education, or previous experience, the chance to get out of a small-pay, no future job, into good-pay, big future work in Radio.

YOUR MONEY BACK IF YOU ARE NOT SATISFIED

That's my way of doing business. And I'll give you that agreement in writing—an agreement to refund every penny of your tuition if, on completion of my Training, you are not entirely satisfied.

INVESTIGATE! Learn why R-T-I Training is different. Find out why R-T-I Trained men get "Quick Results" and "Big Results". Send today for my big book, "Radio's Future and Yours." The book is FREE.

RAY D. SMITH, President — RADIO & TELEVISION INSTITUTE

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NOW MORE THAN 40 RADIO MANUFACTURERS O. K. R-T-I TRAINING AND RECOMMEND IT TO YOU

4 BIG WORKING AND TESTING OUTFITS MAKE R-T-I REAL SHOP TRAINING FOR THE HOME!

R-T-I Training is real "Shop Training" for the home. You learn Radio by doing actual Radio jobs. You test. You measure. You experiment. You train your hands as well as your mind. You don't pay extra for these four big outfits of the latest type apparatus. They're included with your Training. When through training, you build them into practical, workable testing units which help you make money in Radio.

SEND YOUR NAME FOR FREE BOOK

★ THESE NATIONALLY KNOWN RADIO ENGINEERS, Working Right In The Heart Of The Radio Industry, Will Direct And Supervise Your Training

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Send at once, without obligation, your big FREE book, "RADIO'S FUTURE and YOURS," and full particulars of your Working Outfits and Home Study Course.

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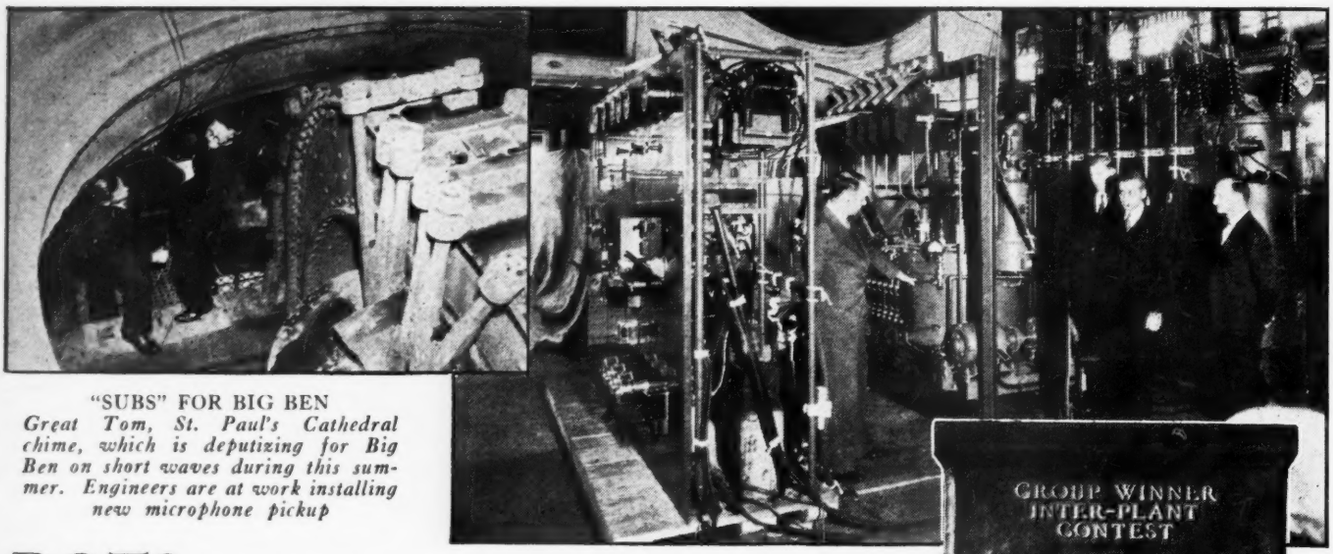
*Address*_____

*City*_____ *State*____



"SUBS" FOR BIG BEN
Great Tom, St. Paul's Cathedral chime, which is deputizing for Big Ben on short waves during this summer. Engineers are at work installing new microphone pickup

WORLD'S LARGEST TUBE
Above: Huge six-foot-girth steel rectifier tube, demonstrated at Milwaukee, has output of 1,000,000 watts at 25,000 volts, d.c. At right. Bronze plaque awarded Raytheon for perfect record of four accidentless years to workers in manufacture of radio tubes

DOTS • • • • • *and* – – – DASHES

Short but Interesting Items from the Month's Radio News the World Over

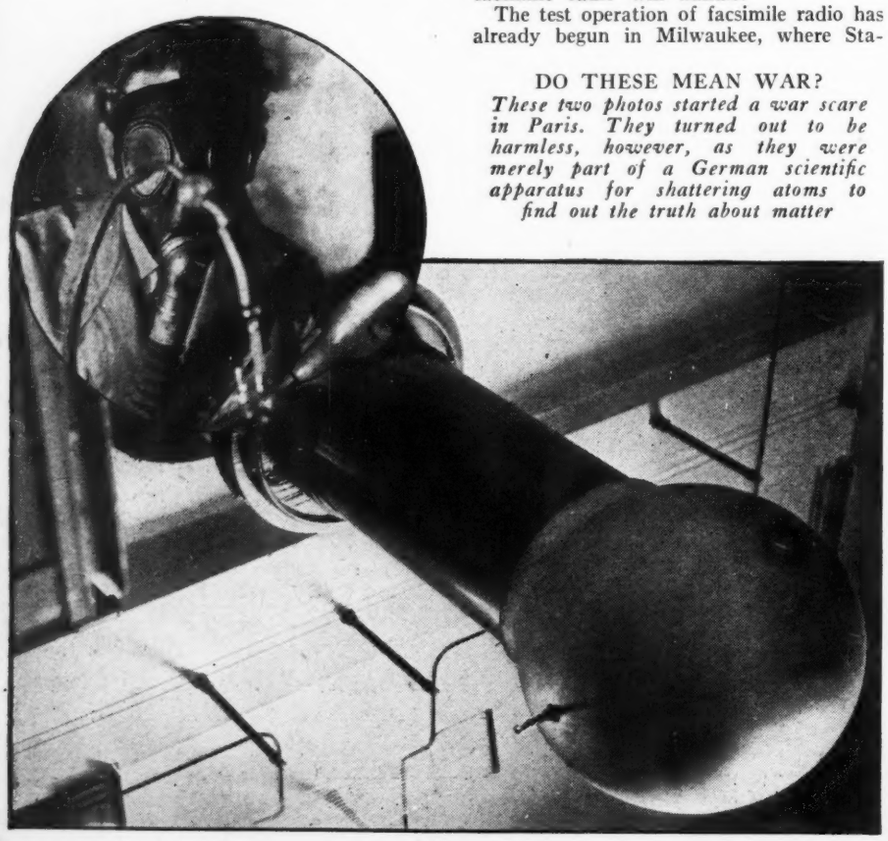
Facsimile Radio Looms Big—Aylesworth

CHICAGO—At the Sloan Dinner here, held in connection with the opening of the Century of Progress Exposition, M. H. Aylesworth, president of the National Broadcasting Company, made interesting predictions for the application of facsimile methods in broadcasting.

"Facsimile radio, that is the sending of pictures and printed matter through the air, is looming on the horizon of science," he declared. "It is uncanny to watch the Radio Pens sketch drawings and words in the laboratories. But as we watch the activity of the tiny Radio Pens as they dart across the paper they seem to move with a businesslike sweep that means they are going some place. I believe the day will come when you will turn on the facsimile receiver, when retiring, and in the morning, and in the morning the paper tape will tell the story of what flashed through the sky while you slumbered. You will find road maps, fashion designs, comic sketches for the children and no end of things, for whatever a pen can portray facsimile radio will handle."

The test operation of facsimile radio has already begun in Milwaukee, where Station WTMJ, of "The Milwaukee Journal," is broadcasting "still" images. Station WOR, Newark, New Jersey, has also applied to the Federal Radio Commission for permission to install an experimental facsimile transmitter.

DO THESE MEAN WAR?
These two photos started a war scare in Paris. They turned out to be harmless, however, as they were merely part of a German scientific apparatus for shattering atoms to find out the truth about matter



A "Galloping" Radio

NEW YORK—A unique horseback receiver known as the "galloping radio" has been built for H. Leslie Atlass, Chicago Vice-President of the Columbia Broadcasting System. Mr. Atlass had special receivers in his airplane, yacht and automobile but he missed some of his favorite programs while horseback riding. So his

A GALLOPING RADIO
Radio receiver designed for H. Leslie Atlass, Vice President of the C. B. S., for keeping him in touch with broadcasts while riding

KEEP AWAY FROM THESE FELLOWS—CRIMINALS!

Above: Officer using radio belt which keeps him advised of disturbances on his beat. Upper left: New radio-equipped motorcycle of the St. Louis Police Department has been found more speedy in catching criminals than police cars

ALERT!

At left: Detroit police car with two-way radio. In circle: Radio equipped London bobby's helmet

engineers promptly designed this unique horseback receiver. The set is strapped to the back of the saddle and can be tuned without looking at the dial. A wire running to the horse's bit serves as the antenna while power is supplied by batteries carried in the saddle-bags.

World's Most Powerful Tube

MILWAUKEE—A demonstration of the first high-voltage, grid-controlled, steel rectifier tube, which is probably at the same time the largest tube in the world, was held recently at the Allis-Chalmers Manufacturing plant, here, before several groups of prominent radio engineers. The tube is six feet in height and three feet in diameter and weighs more than one ton. It is actually the equivalent of six rectifier tubes in one. It contains no filament, but makes use of a mercury arc. Also it is not a sealed-off tube, but contains a vacuum-pump arrangement which maintains the proper vacuum during operation. It is rated at a maximum output of 25,000 volts, direct current, at 1,000,000 watts.

Reports U. S. Suppresses "Terrible" Death Ray

OMAHA—The United States Government has suppressed an exhibition and scientific information regarding a new "death-ray" machine, capable of killing pigeons two blocks away and possibly a forerunner of a terrible future engine of destruction, president A. G. Burns told the Inventors' Congress, here, recently. Burns said suppressive action was taken with the consent of the inventor, Dr. Antonio Longoria, electrical engineer of Cleveland, Ohio. The machine is said to resemble a combination of a motion-picture projector and a radio transmitter. When the ray was turned on, before several government scientists, the test rabbits, cats, dogs and pigeons immediately fell over dead, it is reported.

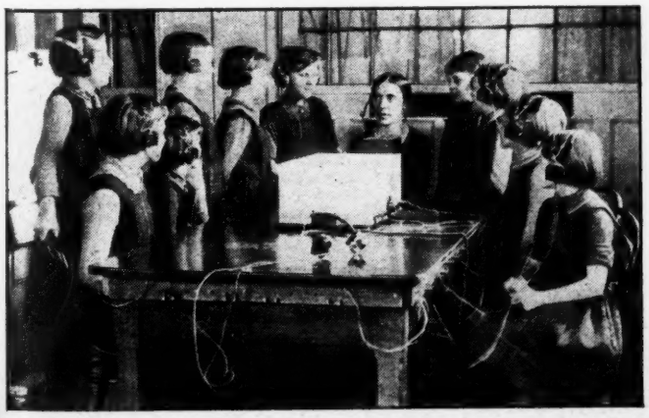
Public-Address System and Loudspeakers in Yacht Races

NEW YORK—The American Yacht Club is using, at the annual regatta on Long Island Sound, a public-address system and loudspeakers with a range of a mile and a quarter for a call system in starting races and getting information to racing boats, according to Ned Hodge, racing committee chairman. These will be used for "recalls" in notifying skippers who

(*Continued on next page*)

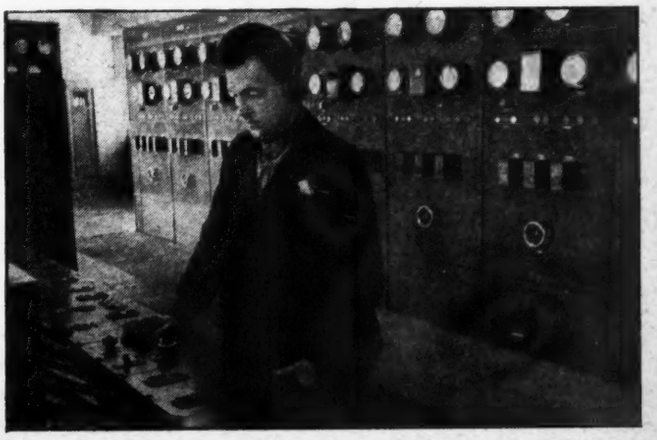
AMPLIFIERS TO TEACH THE DEAF

Radio amplifiers have been developed at Manchester University for use at the Royal School for Deaf and Dumb Children at Manchester. (RADIO NEWS *fostered this development in America.*

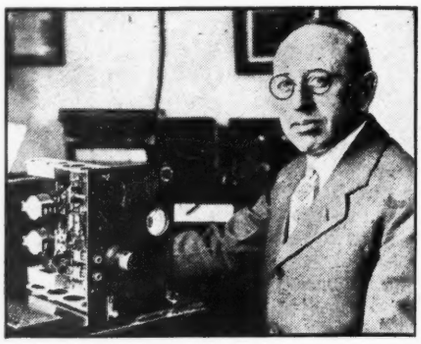


EUROPE'S MOST POWERFUL STATION

The transmitter station "Komintern" in Moscow works on 1724 meters with a power of 500 kw.; the most powerful transmitter in Europe. Photo shows operator at control panel



start before the gun and for keeping the courses clear.



RECEIVES HONOR MEDAL

Captain S. C. Hooper, director of Naval Communications, U. S. A., recently received the Institute of Radio Engineer's annual medal award. He is shown with one of the first high-frequency radio receivers, for aircraft, developed under his supervision

Police to Use Radio on Motorcycles

NEW YORK — Police Commissioner O'Ryan of this city plans to use 50 new radio-equipped motorcycles soon, as speedier units than the radio-equipped police cars.

Chinese to Improve Radio Communication and Wire Services

NANKING—Immediate plans for the expansion of communications in China are being pushed by the National Government. Approximately $3,300,000.00 will be made available as a public loan for this work. The plans are for the betterment of the radio, telephone and telegraph services including new stations and improving and overhauling all trunk telephone and telegraph lines.

Noted Television and Moving-Picture Pioneer Dies

WASHINGTON—Dr. C. Francis Jenkins, pioneer inventor of television and moving-picture systems died here, recently, of heart trouble. He had been in ill health for three years and was 67 years of age. He had won the John Scott and Elliott Cresson gold medals of the Franklin Institute. He made his first moving picture in 1892 and later developed his first televisor.

Electric "Brain" Trained for Army Stratosphere Flight

DAYTON—An unusual assortment of scientific instruments have recently been brought together at Wright field in the Laboratory of the United States Army Air Corps to solve the secrets of the upper air. These devices are controlled by what might be termed "electric brains" and in many cases are equipped with photographic recording "eyes" to make records of the scientific findings, automatically. They were especially made for the use of Captain Albert W. Stevens and Pilot William E. Kepner for their stratosphere flight.

New Radio Telegraphic Services from Japan to the U. S.

TOKYO—It has been announced that the Japanese Government had concluded an agreement with Mackay Radio which was signed by Naotaro Yamamoto, Director General of Telecommunications and Takeo Iino, Chief of the Foreign Traffic Department of the Department of Communications, for the establishment of a new radio telegraph circuit between Japan and the United States. The transmitter in Japan is to be at Oyama with the receiving station at Fukuoka near Tokyo. The American end will be at San Francisco.

Radio News

August, 1934

RADIO RESEARCH

It has been years since radio research activities have been going on at such a fast pace, as now, in American radio laboratories. New things are being discovered and new applications of these discoveries are being made in producing the equipment described in this issue. Tell your friends about this and the following issues to keep them abreast of the new developments

THE last eight months of radio research have been producing some Big New Things in Radio. You will find the real story on these new developments first told accurately in this issue of RADIO NEWS. And you may say, when you read about some of them, "Now that's a good idea, why didn't somebody think of it before," or, "That is just what I have been looking for," or "How is it possible to develop equipment as fine as this at so little cost?"

There are usually three activities that go hand in hand in producing big new things in radio, as in other industries. These might be termed Invention, Research and Development. They are terms familiar to engineers the world over. Still another activity that is necessary in bringing new things into wide public use is termed Production. The modern American engineer is fully acquainted with this term and knows how to produce things on a large scale so that really fine apparatus can be made at the lowest possible cost—and—at a reasonable profit.

New inventions and developments in radio do not "just happen." Naturally, someone has to conceive" the idea. Then someone builds a First Model. After this, one or more engineers may be set at work in some commercial laboratory to develop the idea and produce a Developmental Model. And then one of these Developmental Models may be considered a worth-while device, from a utility as well as a sales standpoint. Other engineers next start on producing a Production Model that is satisfactory to be made in quantity, with an estimated net profit at certain estimated production and sales charges. If the research, developmental, sales and promotional activity, all along the line, have been well done, the device may then start a new mode in radio.

When times are "good" and the individual radio user has money to spend he will buy these new devices for the improvements they give him in radio reception and for the added enjoyment that these automatically bring. When times are "bad" and the individual has little money with which to meet his absolute necessities, he may not be able to afford them even though he is strongly attracted by the most wonderful radio developments. At such a depression period, little research and development work are undertaken, largely because of the great amount of expense, with the small possibility of remunerative return.

However, now that things have been definitely on the upgrade for nearly a year, engineers who are equipped by knowledge, ability and experience to do research and development work are quickly finding new jobs to work on. Research, since the beginning of 1934, has already surged forward and thousands of engineers have been accomplishing wonders in the laboratories, to give the radio industry a *new forward march of accomplishment!*

(*Continued on page* 103)

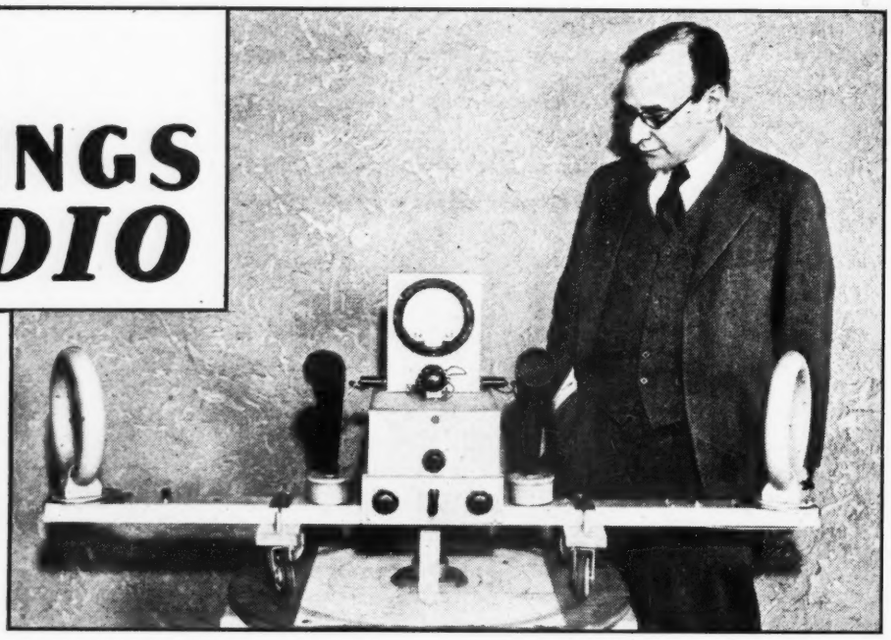
LIVING A LIFE-TIME IN FIVE HOURS

It is not Mr. John B. Hawkins, the engineer whose researches developed the testing device shown below, but an Emerson automobile radio receiver whose life is being crowded into these few hours. The motor-driven test set "jiggles" the automobile radio 1,027,500 times during this period which, according to calculations, would correspond to 50,000 miles of driving. Here is research applied to the problem of producing a long-life automobile-radio receiver

BIG NEW THINGS in RADIO

Brief descriptions of many new radio devices that have just been developed by American engineers

William C. Dorf

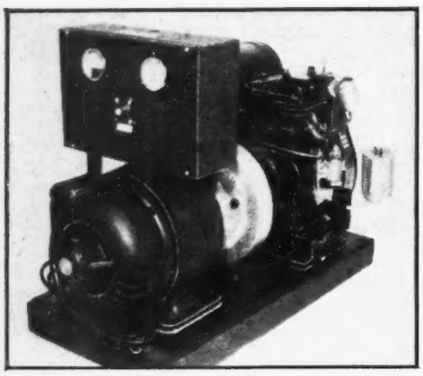


NEW RADIO DIRECTION AND DISTANCE FINDER

This unique radio "brain", the invention of E. J. Simon, will enable ship and aircraft pilots to plot their course and tell exact distances from a lightship or beacon. Such devices would eliminate many accidents in navigation

A Compact Gasoline-Driven Power Plant

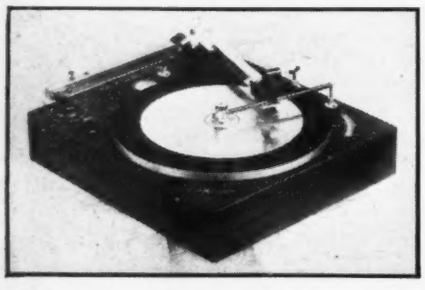
The illustration shows a Kato type 12A, 500-watt, 110-volt, 60-cycle, a.c. light and power supply. Operating economically from a small amount of gas and oil, this power plant can provide a.c. current in any location to meet a wide variety of applications. It can be used for sound truck installations, operating a.c. radio sets, for lighting summer homes and for use on small farms and numerous other applications that will suggest themselves. The newly developed refrigerators which are designed to draw very little current can



be operated from this power device. The Kato power plant meets a real demand in sound truck work. For this type of installation a special noise-reducing cover and muffler are employed. The engine is 4-cycle, 1 horsepower at 1800 r.p.m. The dimensions are 27 inches long by 17 inches high by 15 inches wide and the net weight is approximately 160 pounds.

Recording Instrument

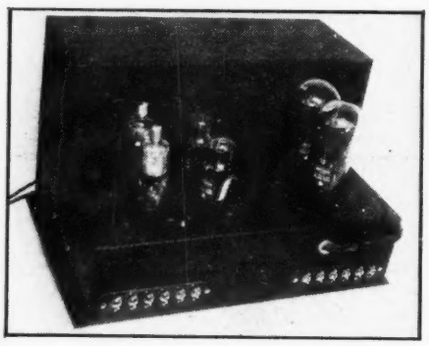
A new semi-professional two-speed, 33⅓ and 78 r.p.m. recording instrument was recently placed on the market by the Universal Microphone Company. The instrument is equipped with a volume indicator, a volume control and a Universal combination pick-up and recording head. Two models are available, one to make recordings on blank aluminum discs up to 12



inches and the other model makes recordings up to 16 inches. The equipment operates from 110-volt, 60-cycle a.c. supply and the two input impedances provided are 400 and 5000 ohms. A dual turntable can be provided for continuous recording.

Six-Volt Automobile Amplifier

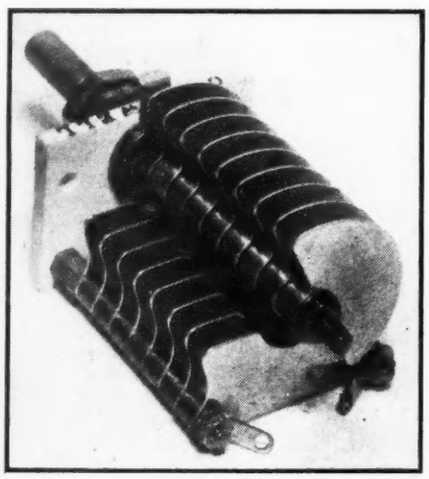
The new Federated Acratone model 745, 6-volt, 15-watt sound-reproducing system applicable to automobile and marine installation uses a small Gene-motor power device to supply 300 volts at 120 milliamperes directly from a 6-volt storage battery. This generator is suspended on four rubber-cushioned mountings, reducing mechanical vibration to a minimum. The amplifier features a built-in microphone current supply and a tone control. Input connections are provided for single- or double-button microphones, a low, medium or a high impedance phonograph pick-up and a radio



tuner. The circuit uses three push-pull stages with two 77's, two 76's, and two 46's. The chassis measures 14 inches by 9¾ inches by 9 inches and the total shipping weight is 30 pounds.

Midget Variable Condensers

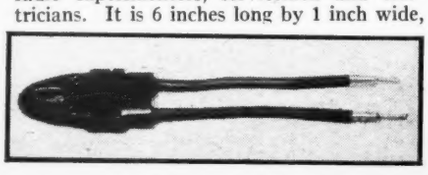
The new Cardwell "Trim Air" small size condensers have several unique features. The rotor can be locked in position for use in band spreading systems and for neutralizing. The shaft of these condensers are threaded so that two or more of the units can be easily ganged together if desired. They are constructed of aluminum and are insulated with Isolantite. These condensers are made in nine types the smallest unit, the RT15 type having a minimum capacity of 1.5 mmfds. and a maximum capacity of 15 mmfds. The largest unit RT140, has a minimum of 4.5 and a maximum of 140 mmfds. The condenser shown in the illustration is the transmitter type, XT30, the capacity being 2.0 to 30 mmfds. The air gap of this unit is .070 inches and the depth behind panel

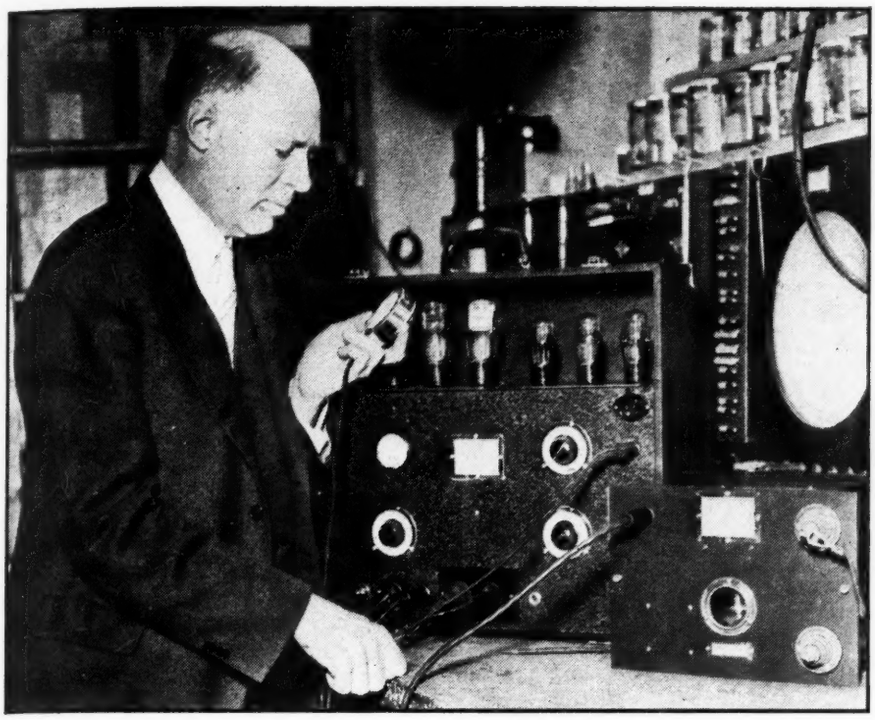


is 2⅛ inches. Panel space dimensions are 1 7/16 wide by 1¼ inches high.

A Handy Device

The Eagle Detecto-Lite, employing a neon lamp enclosed in a bakelite case and equipped with two flexible connecting leads, will tell at a glance if the line supply is a.c. or d.c. On alternating current both electrodes of the neon lamp will glow, whereas on direct current only one electrode will glow. This device will also tell the frequency of the line, the live and ground side of the line, and it can be made to act as a pilot light on any electrical apparatus. It should prove popular with radio experimenters, servicemen and electricians. It is 6 inches long by 1 inch wide,





TWO-WAY TELEPHONE FOR MARINE USE

A new system for voice transmission between ships and port dispatchers in foggy weather is the invention of Earl C. Hanson shown using the device

being of convenient size to slip into the pocket.

New All-Wave Receiver

The Stewart-Warner "Magic Dial" all-wave twelve-tube superheterodyne receiver features a specially designed tuning dial which has four separate sets of cali-

brations, only one of which is visible at a time. These markings cover the standard broadcasting band and three different short-wave ranges. The movement of a simple selector switch instantly replaces one set of markings with another according to the range in which the desired station will be found. In addition to this feature the set is equipped with adjustable tone control, automatic volume control and a vernier tuning control. The set uses two 57's, three 56's, three 58's, one 55, two 2A5's and one 80 type rectifier. The walnut finished console housing the receiver measures 40½ inches high by 25 inches wide by 17 inches deep.

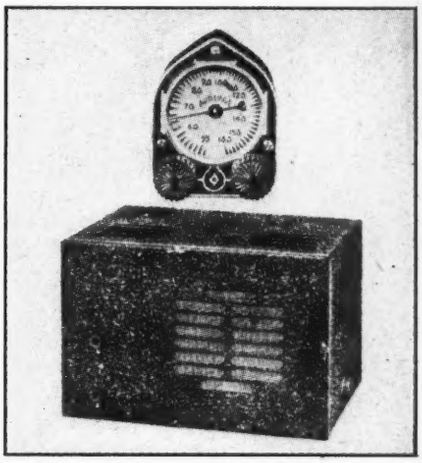
Condenser Analyzer

Tobe Deutschmann Company has just brought out a new instrument to test paper, mica and oil dielectric condensers. They are tested by the method of measuring the d.c. resistance under an applied voltage. The resultant leakage current is indicated by means of a special neon glow

tube indicator. Good condensers having a satisfactory high resistance, as well as those which are open, shorted, intermittently open closed, or leaky are indicated by this instrument. Defective electrolytic condensers are detected by this instrument. The device contains a built-in 110-volt, 60-cycle, a.c. power supply. Voltages up to 700 volts d.c. are available for testing at the output terminals. The size of the analyzer case is 3¾ inches by 4½ inches by 7½ inches.

New Single Unit Receiver

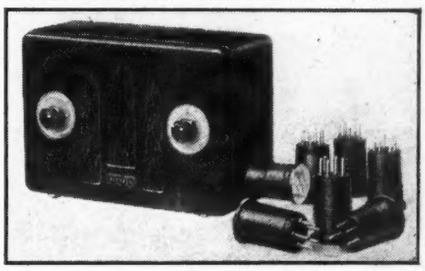
An announcement was recently made of the new Audiola model B-6 automobile six-tube receiver. The set has been designed for simplicity of operation and installation. It is equipped with the new airplane type remote control, automatic volume control, and the Jensen five-inch dynamic speaker. Due to the new mechanical and electrical design of the set, spark-plug suppressors



are not required. It delivers three watts power output, and the tube equipment includes two 6D6's, one 6A7, one 75, one 41 and one 84 type rectifier.

A New Four-Tube Multi-Wave Receiver

Description—This company recently introduced the new Fordson model FV four-



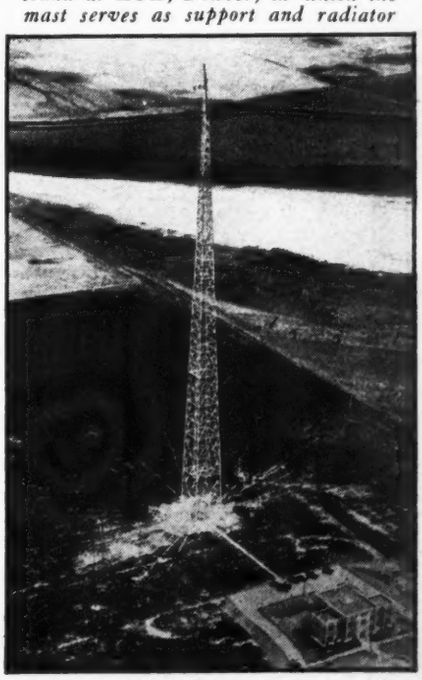
tube a.c.-d.c. receiver, employing plug-in type coils covering a wavelength range from 15 to 2700 meters. It utilizes the latest type tubes, is equipped with a dynamic speaker and is simple to operate.

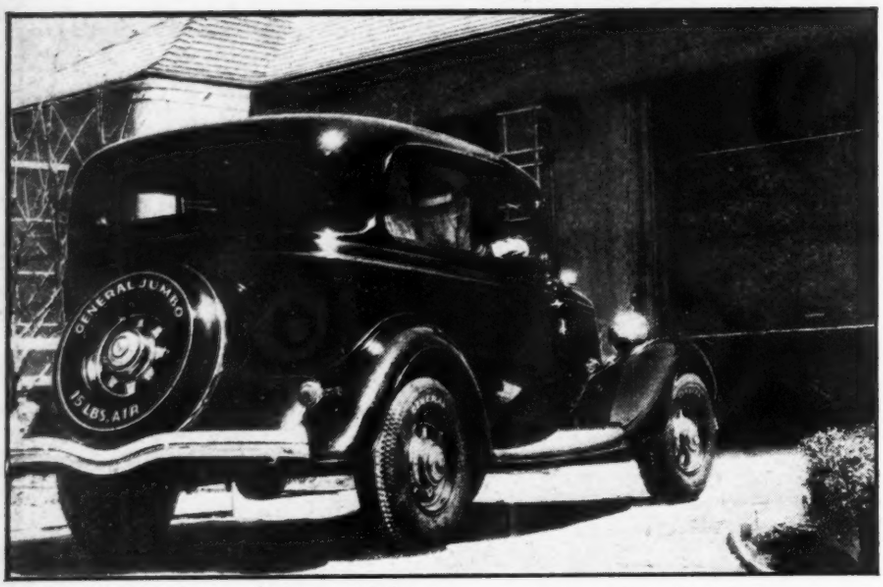
Vertical Type Transmitting Antenna Rapidly Gaining in Popularity

The International-Stacey Corporation, engaged for many years in tower construction for practically every purpose, are now

"WIRELESS" RADIO MAST

This is the new self-supporting antenna at KOA, Denver, in which the mast serves as support and radiator





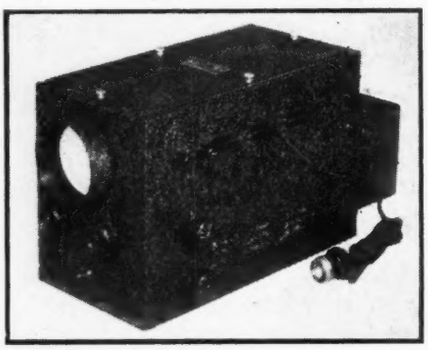
RADIO CONTROL
OPERATES GARAGE DOORS

Millions of visitors to the Century of Progress Exposition at Chicago have watched this automobile, which contains a radio control, open and close the doors of a model garage

building towers for vertical transmitting antenna systems. The use of high towers to serve as vertical antenna radiators met with instant success on its inception about two years ago, and that the popularity of the vertical type antenna has been increasing is attested to by the fact that this company has just completed installing a 470-foot tower for an "Instaco" vertical transmitting antenna for the General Electric Company Radio Station KOA at Denver, Colorado. This is said to be the highest self-supporting tower in the United States. It is only 35 feet square at the base and the 50-ton weight of the tower bears down equally on four huge porcelain egg-shaped insulators. It is constructed to withstand a 125-mile-an-hour gale. The Buckeye Sheriffs Association commissioned this company to install a 220-foot tower for their new radio station, WPGG, at Findlay, Ohio.

New Cathode Ray Oscilloscope

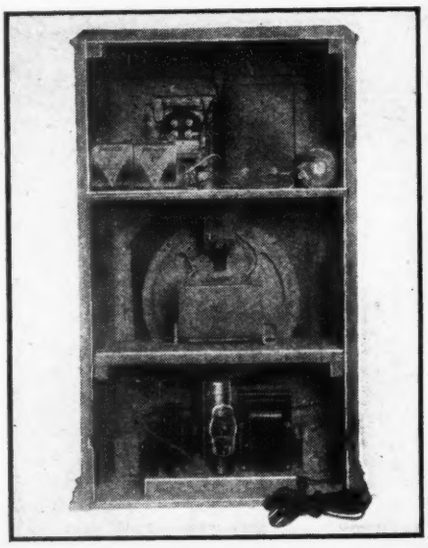
The National model CRO cathode-ray oscilloscope is entirely self-contained with its own power supply and built-in control devices. This instrument provides an instantaneous graphic picture of the actual operating conditions in transmitting circuits. The cathode-ray tube employed is the new RCA three-inch-diameter type 906. No linear sweep device is provided, as it has been found more desirable to use an audio signal from the transmitter for this purpose. The resulting "trapezoid pattern" may be interpreted more readily, and



percentage of modulation more easily calculated, than with a linear sweep. However, the linear sweep may be added at any time if it is found necessary for special work. The dimensions of the cabinet are 18 inches by 8 inches by 6 inches. The power supply employs the 80 type rectifier in a half-wave circuit.

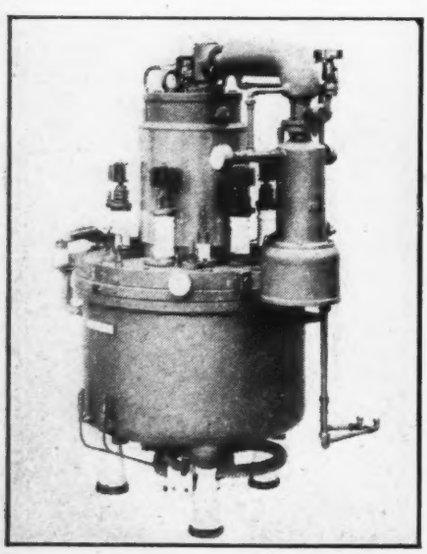
Universal Shop Tester

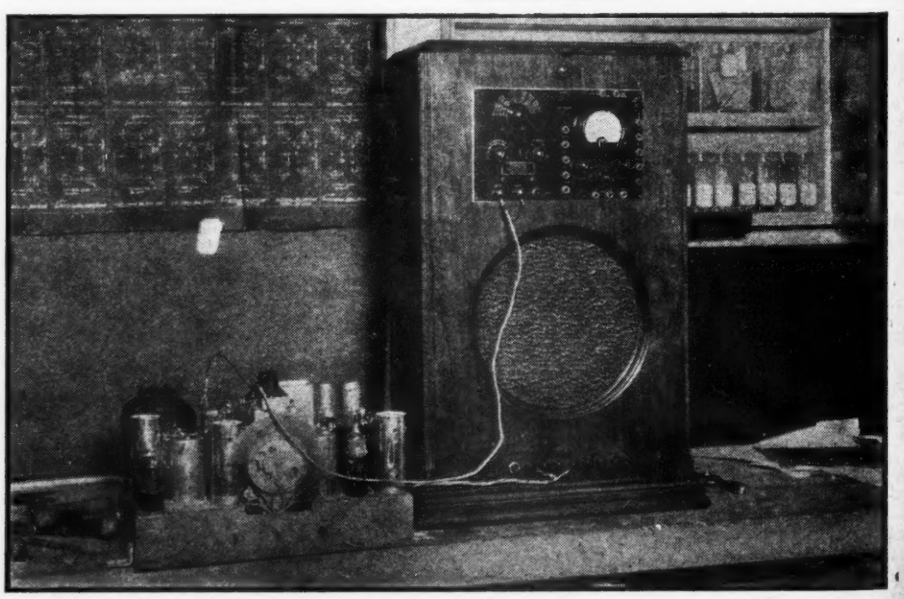
The new Philco model 059 test cabinet meets a long felt want on the part of the serviceman and the dealer for complete universal shop testing equipment for servicing all types of radio receivers. The tester is completely self-contained and provides complete facilities for all necessary receiver tests. The tester equipment includes a variable frequency signal generator with a range from 105 to 2000 kc.; a 500 microampere rectifier type meter with 5 a.c. voltage ranges, 5 d.c. voltage ranges, 3 d.c. milliammeter ranges, 3 ohmmeter ranges and 5 a.c. output meter ranges. Capacity meter connections can also be supplied and the equipment can be used as a tube tester if desired. All of the necessary leads, test prods and adapters are included. The test cabinet is equipped with a 15 watt dynamic type speaker complete with its own exciter for field supply. Four dummy field coils are built-in for the purpose of substituting the speaker field on any set being tested. The speaker may be operated from sets having a single or a push pull output tube. The outstanding advantage of a tester of this type is the fact that it eliminates the necessity of having several types of extra speakers available in the shop when testing various radio chassis. This means that the serviceman need only remove the radio chassis from the customer's cabinet and thus save time and trouble. The large illustration shows



WORLD'S LARGEST TUBE

This is a close-up of the 1,000,000 watt steel rectifier tube capable of rectifying enough electrical energy to light the homes of a city of 65,000 people. (*See this month's Dots and Dashes for more information.*)





the test cabinet connected to the radio set ready for test. The other illustration shows the rear view of the cabinet with oscillator, set tester, speaker and speaker power supply. The dimensions of the cabinet are 27¾ inches high by 18 inches wide by 9 inches deep. The weight, complete with batteries is 62 pounds.

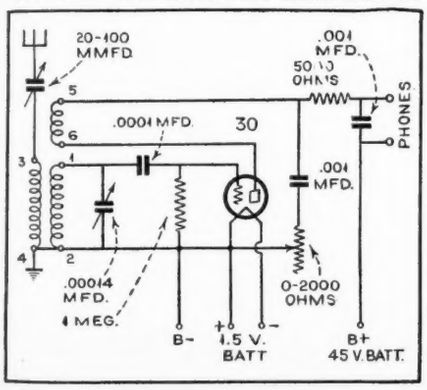
Phonograph Pick-Ups

The Upco Engineering Laboratories introduces a new line of complete phonograph pick-ups, pick-up heads, recording heads and phonograph reproducers for use with standard receivers, audio amplifying systems and for professional recording and reproducing work. The Symphony model herewith illustrated should find wide application in auditorium, theatre and studio work. It is eighteen inches overall in length, accommodating the 16-inch-size broadcast records. The pick-up is available in impedances from 3 ohms to 10,000 ohms and the arm can be balanced for correct pressure on the record by an adjustable weight. The pick-ups are precision built and free from vibration, and all models can be supplied with or without volume control. The pick-up head em-

ploys English cobalt magnet with special solid steel pole pieces and armature.

One Tube Short-Wave Kit

The complete kit of parts with easy to follow instructions are made available by the Insuline Company of America for constructing the new I.C.A. Universal Mascot model 1, one tube short-wave receiver. It employs a type 30, two-volt tube and covers the four short-wave bands from 16



RADIO EQUIPMENT FOR NEW HAVEN ROAD

An experimental 5-meter radio 'phone developed by Westinghouse for the New Haven Railroad enables two-way radio conversation between the engineer, shown in circle, and the caboose at the end of the train

to 217 meters. Additional coils for reaching the low wavelengths from 9 to 21 meters and to cover the broadcast band from 190 to 550 meters are also available. The set is enclosed in a black bakelite case measuring 6¼ inches by 5⅛ inches by 2⅜ inches. The Phone tip jacks are mounted on the front of the panel. The circuit consists of a standard regenerative detector and the construction of the set offers no difficulties.

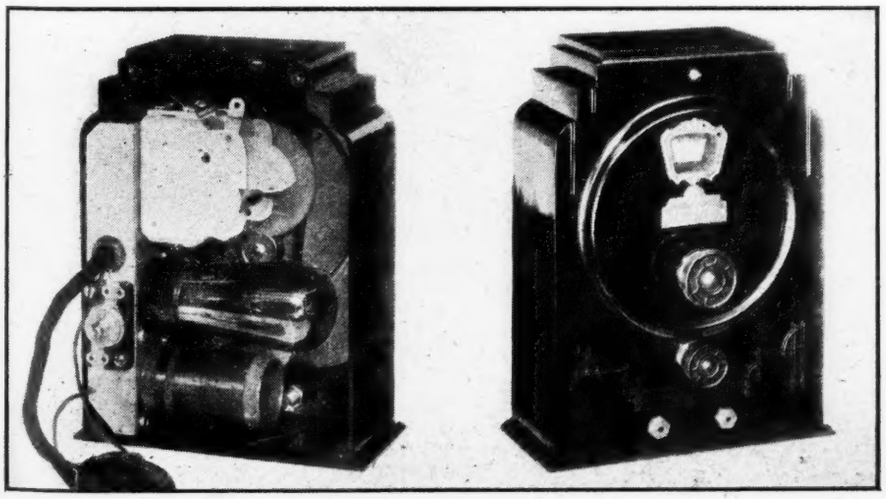
Class A Prime 30 Watt Amplifier

The Allied "Knight" power amplifier herewith illustrated is designed for a gain of 92 db. with an output of 30 watts undistorted sound energy. It employs ten tubes for the following purposes: two 58's in a resistance-coupled stage, followed by two 56's transformer-coupled to four 2A3's in a parallel push-pull Prime A power stage. The type 83 rectifier is employed for the plate supply and the type 82 rectifier is used to provide an independent bias voltage for the 2A3 type tubes. The frequency response curve shows the amplifier to be flat within plus or minus 2 db. from 60 to 10,000 cycles. In designing the amplifier, the important idea has been kept in mind that it be universal in application. The input is arranged for a single- or double-button carbon type microphone, high-impedance phonograph pick-up and a 500-ohm line. The output transformer is tapped at 4, 8 and 16 ohms for dynamic voice-coil connections and at 500 ohms for an output line. This powerful amplifier is especially adapted to public-address in-

(*Continued on page* 128)

A RADIO NOVELTY

Leroy M. Cox invented this model radio entertainer which, when placed near the radio and connected to the same with a pair of wires, produces a very amusing and comical effect. The chin and lips of the model open and close in unison with the conversation or singing over the radio



STATION
W2XAR
OPERATING
ON A
FREQUENCY
OF
1594
KILOCYCLES
OWNED AND
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RADIO
PICTURES
INC.
41 PARK ROW
NEW YORK

FLASHES
FROM
The
Sun

GULF LINKED
TO CHICAGO

PUBLIC WORKS
PLANNED TO AID
CITY'S JOBLESS

COL E. M. HOUSE
SEES PRESIDENT
AT GLOUCESTER

INDUSTRY ASKED
TO AVOID RUSH
OF PRODUCTION

If Not "TELEVISION"

Laurence M. Cockaday

A SIMPLIFIED facsimile system using a visual reproduction method which prints, with ink, words and pictures on a three-inch wide paper tape was recently demonstrated by John V. L. Hogan on the 23rd floor of the Hotel St. Moritz in New York City. The device is a high-speed facsimile radio system designed with the needs and requirements of home radio users in mind. A transmitter of this type has been installed by the Milwaukee Journal operating station WTMJ for experiments in transmitting and receiving visual printed programs. Three receivers have also been installed in department stores in Milwaukee. In spite of the recent "scare" headlines of "radio printed newspapers" broadcast and received in individual homes over night, Mr. Hogan prefaced his demonstration with the remark that there is nothing new in the mere idea of facsimile operation or transmission of recorded text and pictures by radio. He pointed out that the transmission of pictures and even written messages by facsimile service is many years old. He stated, however, that the high cost and expert operation necessary for a real *commercial* type of service would be prohibitive when associated with efforts to use such *commercial* types in the home. Mr. Hogan pointed out the following eight characteristics that must be contained in a recording system for successful home use.

1. The design must be sufficiently simple to permit sale of the receivers at prices about the same as those of broadcast receivers.

2. The operation of the receivers must be so simple that they can be successfully handled by unskilled users, and the receivers must be capable of running for considerable periods of time with little or no attention.

3. The recorded pictures and text must be produced on plain paper, so as to avoid the nuisance, delay and expense involved in any chemical or photographic processing.

4. The operation of the receiving recorder must be fully visible so that the user may see each mark as it is being made. This lends interest to the use of the system, but, more importantly, shows at once whether or not receiving conditions are correct.

5. The recorders must have a continuous paper feed, so that it is not necessary to reload the machine for each picture.

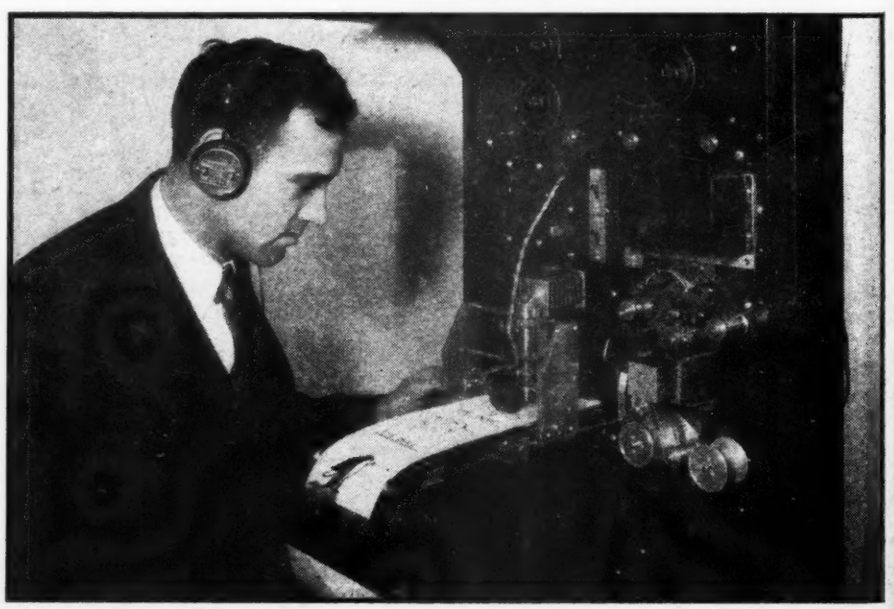
6. The received record should be made in ink. so as to provide a permanent, easily-handled, non-smudging, and dry copy.

7. The speed of the operation should be relatively high, so that the user will not have to wait unduly long for each finished picture.

8. The reproduction should be sufficiently clear and crisp to permit the

THE RADIO PICTURE TRANSMITTER IN ACTION

Figure 1. Here is the new radio strip transmitter actually in operation. It is equipped for transmitting either from black-and-white or from a moving picture film



¶ So many people ask: "Are we ever going to have television in our homes?" Instead of replying, the Editors ask another question: "How would you like to have an attachment for your receiver that would print the original strips of text and illustrations shown on these pages?"

Why Not

"FACSIMILE"

system to carry text at telegraphic speed.

The devices demonstrated at the St. Moritz are known as "Radio-Pen" receivers and print, on a continuous three-inch paper tape, pictures or written words of sufficient size to be clearly visible in a good-sized room. One of these receivers is shown in Figure 2, connected up to a standard receiving set. Reproductions of the printed tape are shown on these pages.

The system itself really is a sort of slowed-up television system in which a mechanical scanning system slices the picture to be transmitted into small rectangular sections in the same manner that a scanning disk would do. The speed of transmission, however, is enormously slowed down. (Editor's note: Good thinking here. Television is too poor at present day speeds. But slow it down and we can still have a good printing radio system!) On the receiver (instead of a scanning disk) is a sliding arm which moves horizontally across the tape and which carries a magnetically-operated self-inking pen. As the pen passes over the surface of the paper an incoming signal can make it touch or lift off the paper. This results (during the printed process) in a series of closely spaced ink lines shading the tape into lighter or darker areas for reproducing either pictures or printed words. Such a system is illustrated in Figure 2, being operated by Mr. Hogan.

The signals were transmitted, during the demonstration, from the laboratories in Long Island City, from a transmitter similar to that shown in Figure 1. The actual picture signals are superimposed on a sub-carrier of about 2,000 cycles and this in turn is superimposed on a radio-frequency carrier of 1594 kc. The transmitting station's call is W2XAR. The sound program was sent out by W2XBR, in the same laboratories, operating on 1550 kc. The printer transmitter is arranged so that it operates directly from pen-and-ink drawings, typewritten text or printed matter, directly from a newspaper. This eliminates both the cost and the delay of any preliminary processing necessary with Mr. Hogan's first machines that used a film. The new transmitter obviates the necessity of making this motion-picture film or other photographic copies of the material to be transmitted. In this way news can be flashed as soon as received! The film transmission method can still be used, however, for such things as station announcements and for material which is likely to be repeated a (*Continued on page* 113)

THE INVENTOR DEMONSTRATES THE "RADIO PEN"

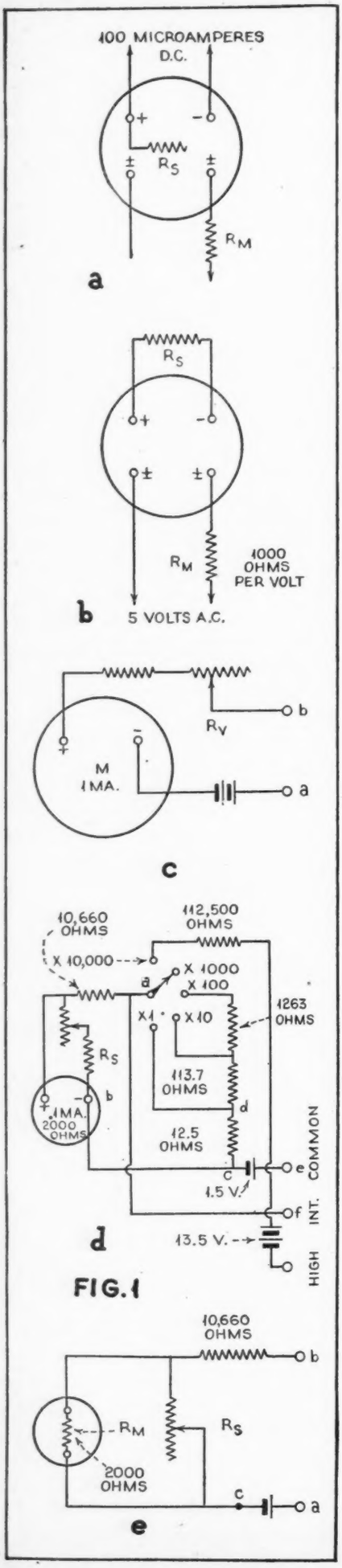
Figure 2. John V. L. Hogan tuning in a standard receiver to which is attached the simplified facsimile printer which can be used for home reproduction of illustrated news in "galley" form (news printed on a long length of paper tape)

RADIO NEWS SERVICE
UNIVERSAL

This month the author describes a some unusual features. Next month for the benefit of servicemen who

John H.

Part



THE greatly increased complexity of radio receiver circuits, resulting from the general adoption of multi-element tubes, has emphasized the limitations of older types of service test equipment. Manufacturers, designers and servicemen have attempted to keep pace with progress in receiver development by revamping older test circuits and apparatus. While these design changes have served to adapt such test instruments to a wider range of usefulness, it is becoming generally recognized that the heart of the usual test instrument, the 1 ma. meter, is of inadequate sensitivity to fully meet present-day requirements. A few manufacturers have adopted meters for their set testers with a basic sensitivity of 2000 ohms per volt, or slightly higher. For the wide range of tests for which apparatus to be described in this series is designed, much greater sensitivity is required.

Since no suitable universal meter was commercially available, specifications were drawn up by the RADIO NEWS staff for a special meter and submitted to the Weston Electrical Instrument Company. As a result a new universal meter of most unusual sensitivity, yet thoroughly rugged, was developed and placed on the market by this company. The use of this meter enables the writer to present in this and another article to follow next month, a universal tester with eleven d.c. voltage ranges, eight of which provide a sensitivity of 10,000 ohms per volt; five resistance ranges which provide measurements from a fraction of 1 ohm to 5 megohms; eight a.c. voltage ranges and eight d.c. current ranges. Provision has likewise been made for capacity and output measurements. It is doubtful that any single unit test instrument of its type to date has an equal range of application. Precision resistors are used throughout and the measurement ranges for resistance, current and voltage have been designed to close tolerances to assure dependable accuracy.

THE meter unit discussed in this article is a compact, rugged, portable instrument which provides an unusually wide variety of a.c., d.c. output, capacity and resistance ranges. D.C. ranges as low as 0-0.5 volt and 0-0.1 milliampere are provided, 8 of the 11 d.c. voltage ranges functioning at a sensitivity of 10,000 ohms per volt. This meter unit constitutes a comprehensive tester in itself, but for servicemen who also employ the "analyzer" method of set testing a small analyzer panel for use with this meter unit will be described in the October issue.

—The Editors.

A schematic diagram of the tester circuit is shown in Figure 2. The internal connections to the Weston model 301 special 100-micro-ampere universal meter are indicated by the dotted lines in the schematic diagram of Figure 2. The method of connection for d.c. is shown in Figure 1a, and Figure 1b indicates the proper connections for a.c. use. The resistor, Rs, and the multiplier, Rm, should be obtained from the manufacturer in order to match the meter to its scale.

In Figure 2, S1 is a 4-deck, 10-point rotary switch and is used to select the various current, voltage and resistance ranges. S2 is a 3-deck, 5-point rotary switch of the same type and is used to select the a.c. and d.c. voltage and the resistance and d.c. current circuits. Small output pin-jacks are provided for resistance, current and voltage An extremely sensitive arrangement for output work is provided.

Since the resistance measurement is of fundamental importance in all service work, particular attention has been devoted to this feature. The five ranges supplied provide for measurements of from about 2/10 ohm to 5 megohms with a maximum battery voltage of 15 volts. To obtain an equivalent deflection for 5 megohms, using a 1 ma. meter, would require a battery voltage of 150 volts. Many testers use high voltage for resistance measurement. When batteries are used, if they are of small size, they quickly dry out and must be replaced. If larger, the weight and bulk are a serious handicap. When testing a.c.-d.c. midgets, unless care is used, breakdowns of the 35-volt midget electrolytic condensers occur at excessive test voltages.

Figure 1c shows a popular ohmmeter circuit which has many drawbacks. Using a 1.5-volt battery, when terminals a and b are joined and Rv is adjusted until the 1 ma. meter reads full scale, the total circuit resistance is 1500 ohms. If 1500 ohms is now inserted between the terminals a-b, the total resistance in the circuit is increased to 3000 ohms and, accordingly, the meter reads half scale. Let us now assume that the

INSTRUMENTS No. 2
MULTIMETER

universal test meter which offers constructional details will be given want to build and to use this unit

Potts

One

battery voltage has fallen to 1.35 volts. Closing terminals a-b, we are compelled to readjust Rv until the total circuit resistance is 1350 ohms, to obtain full-scale deflection. Now, if we insert between terminals a-b a resistance of 1350 ohms, we find that we obtain the same reading as was previously obtained at 1500 ohms. The percentage error at this point is therefore proportional to the percentage drop in battery voltage. Further difficulty arises with this type of circuit when it is used as a multi-range ohmmeter. In such cases, it is necessary to readjust Rv each time the range is shifted, or use separate rheostats for each range in addition to the necessary meter shunts.

The multi-range ohmmeter circuit employed in this tester is shown in Figure 1d. Despite its simplicity, high accuracy may be attained and a single adjustment of Rs suffices for all ranges. The error in reading due to design is less than 1 percent. Let us consider the 1000 scale, shown in Figure 1e. Since our dial is calibrated with a 12.5 ohm center, to obtain a half-scale reading with 12,500 ohms inserted at the test terminals, a-b, the resistance of Rm and Rs in parallel, plus the series resistor, 10660 ohms, must equal 12,500 ohms. With a battery voltage of 1.5, the current in the circuit, with terminals a-b joined will be 120 micro-amperes. With the meter, Rm, adjusted for full-scale deflection by varying Rs, 100 micro-amperes will pass through the meter and 20 microamperes through Rs. Since the meter has a resistance of 2000 ohms, the resistance of the shunt, Rs, when so adjusted, will be 10,000 ohms. The resistance of Rs and Rm in parallel will be 1833 ohms. Adding this to 10,660 ohms, the total comes to 12,493 ohms. The design error is therefore less than .6 of 1 percent. Assuming that the battery voltage has dropped to 1.35 volts, the current in the circuit will then be 108 micro-amperes, of which 8 micro-amperes will pass through Rs. When Rs is so adjusted, its total resistance is about 24,300 ohms, which, in parallel with Rm, gives us 1847 ohms. Adding this to 10,660 ohms, the total resistance comes to 12,507 ohms, instead of 12,500. Thus the error is still less than .6 of 1 percent. A more precise mathematical analysis would show even less error but is not considered necessary here.

If terminals a-c are connected across points c-d, as shown in Figure 1d, we are set up to measure very low values of resistance. Closing terminals e-f, the total current in the circuit is 120 milliamperes at 1.5 volts, of which 120 *micro*-amperes are drawn by the test circuit portion shown in Figure 1e. Since the test circuit load affects the reading to the extent of but .1 of 1 percent no compensation has been made for the load. For the other ranges, the resistance of the divider circuit has been adjusted to compensate for the test circuit load at each range.

The writer does not wish to give the impression that in actual use this ohmmeter can be depended upon to read resistance values accurately to within a fraction of 1 percent. Slight percentages of error in individual shunt resistors, and the meter, when cumulative, will affect the accuracy. What we do wish to emphasize is that avoidable error has been eliminated, to a great extent.

The method of obtaining 11 voltage ranges, from .5 to 1000 volts, with but 8 precision multipliers and a shunt, is another of the design features of this instrument, effecting economy without sacrifice of accuracy. The usual voltage multiplier circuit is shown in Figure 3a. If a 1 ma. meter is used and ranges of 10/50/100/500 volts are required, assuming the internal resistance of the meter to be 27 ohms, the values shown in Figure 3a will apply. The current drawn from the circuit under test would be 1 ma. at full (*Continued on page* 127)

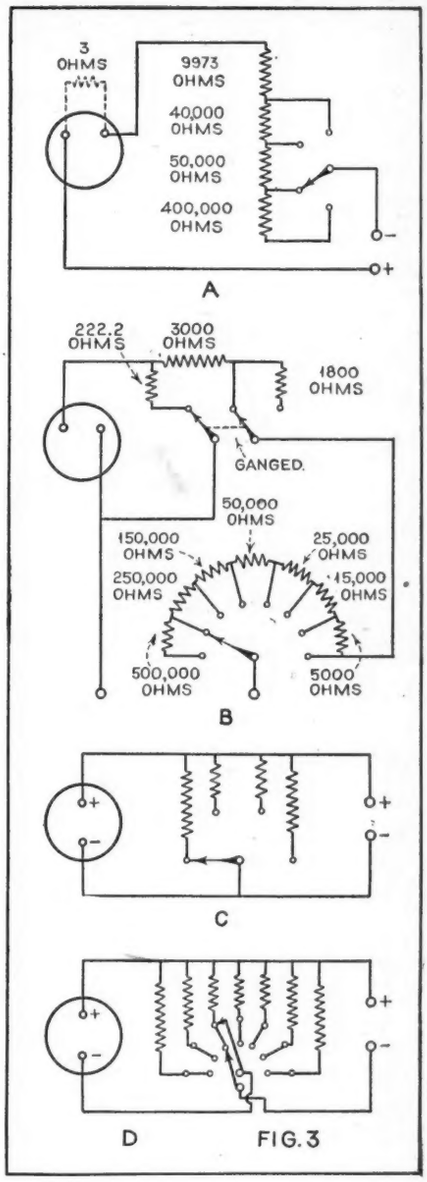


FIG. 3

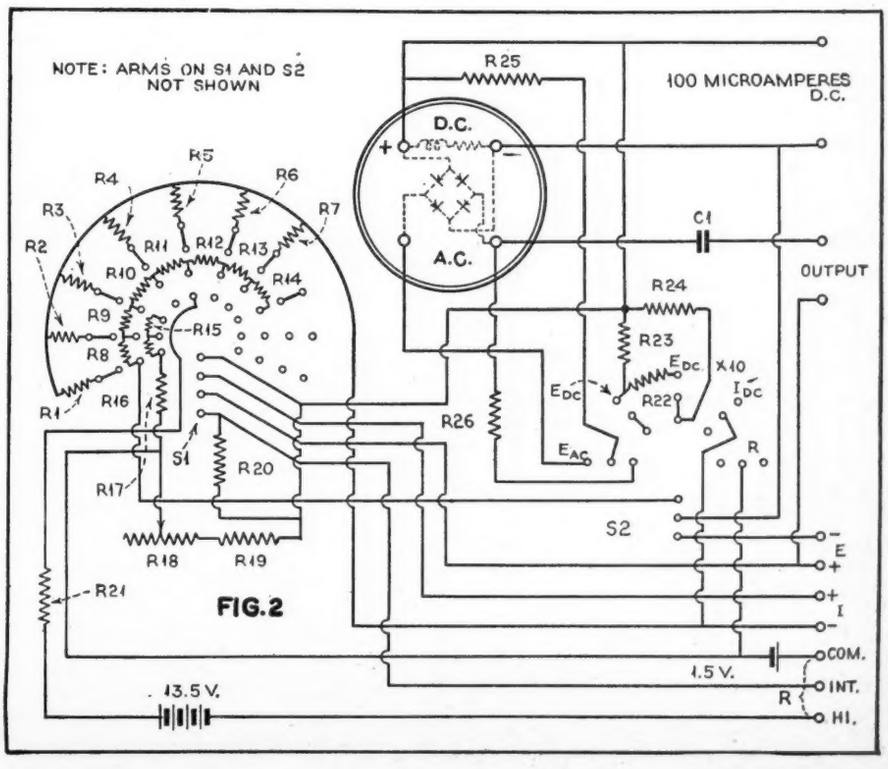


FIG. 2

New Acoustic Method for

CHECKING *TIMEPIECES*

Frederic Siemens

NEW industrial applications of electronic principles are represented in the new devices known as the Chronograph and Chronoscope which have been hailed as boons to the watchmakers' art.

Various technical features of facsimile picture transmission are incorporated in the devices recently developed in the RCA-Victor laboratories. The new instruments enable the manufacturer or repairman to make precision tests of watch instruments *without opening the case!* The system is far more accurate than physical methods of watch mechanism observation.

Components of the Chronograph are a frequency standard, a printing device and an amplifier. A precision tuning fork which is temperature-controlled represents the frequency standard. This controls the speed of a motor which drives the recording paper. It is so arranged that the paper is moved forward one inch for each elapsed minute of time. The watch is first placed in a crystal-microphone chamber. The crystal device was chosen so that there could be no magnetic interference with the watch mechanism. The microphone case is designed to be tilted to check the watch in various positions.

When the watch is accurately timed, the ticks appear on the recording paper as vertical lines because the sounds occur in synchronism with the standard of time. If the watch is fast the ticks will arrive earlier on the paper and the vertical line tilts in a clockwise direction. If the watch is slow, the line tilts in the opposite direction.

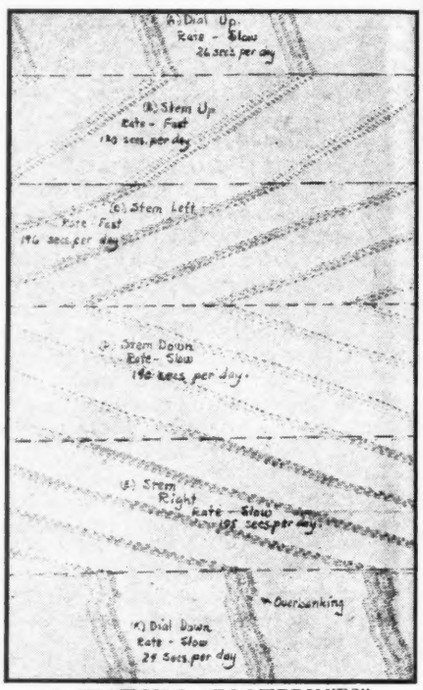
Many things can be determined with the device. The accurate rate of the watch in any position may be recorded and any variation such as caused by bad gear teeth, binding bearings, etc., is disclosed. The average rate is obtained by the general slope of the recorded line, but any instantaneous variation is also shown by a divergence from the average line slope. Only the sound of engaging and disengaging the escapement actuates the printer. The watches can be timed with rare accuracy, depending upon the length of time they are under observation. Within a five-minute interval the accuracy of a watch may be determined to within eight-tenths of a second per day. Shorter or longer periods of observation can determine lower or higher values. An accurate check of the frequency standard in the chronograph can be made by receiving the United States Navy time signals by radio and recording them by connecting the amplifier to the receiver's output.

The chronoscope, a portable device, incorporates two systems. The first provides a means of amplifying the various sounds due to rubbing hair-springs, broken jewels, etc., and the second provides for checking the watch rate to within two seconds per day in an observing time of less than ten minutes. This device functions on a.c. mains supply.

A similar tuning fork arrangement as the chronograph regulates the speed of the chronoscope motor, which, in turn, drives a disk with a single hole. The hole rotates at the rate of one revolution per second. The watch is placed in a container on top of a small microphone for the test. The microphone is connected to an amplifier and to the output of a neon light. Hence, every time the watch ticks, the neon bulb flashes. These flashes will occur four, five or six times a second, depending on the watch, but as the stroboscope disk has but a single hole, just one flash each second will be discernible. It is required that the disk and lamp be adjusted that a flash should occur each time the hole passes the bulb. Observations may then be taken at intervals to determine the variances of the watch as compared to the tuning fork driving the motor. The drift can be seen by the flash's gradual shift from the starting position and its recurrence earlier or later than the arrival of the disk hole into view. The adjusting handle of the stroboscope is then moved to compensate for the drift, while leaving the scale fixed, and the angle of motion necessary to bring the flash back into full view is a measure of (*Continued on page* 103)

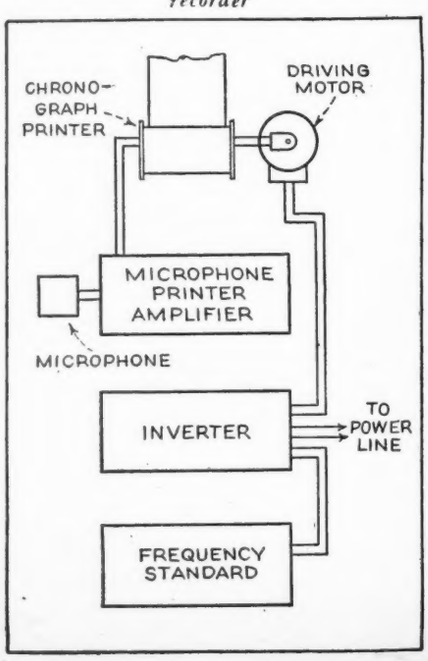
RAPID WATCH-TIMING CHRONOGRAPH

Using tubes and amplifiers to print an accurate record of a watch's ticks. Spherical microphone on table holds watch



A WATCH'S "FOOTPRINTS"

The tracks above were made by the ticks of an erratic watch. Below is a schematic diagram of the chronograph recorder



THE PORTABLE CHRONOSCOPE

This unit is for use in the field where watch-makers may actually listen to amplified watch ticks to determine loose bearings, scraping hair-springs and other troubles

A Combination HEARING-AID RADIO

Samuel B. Simer

READY FOR SERVICE

This view shows the revamped midget with accessories. With switches SW1 and SW2 down the outfit functions simultaneously as an effective hearing aid and as a radio. With SW1 down and SW2 up the radio function is eliminated. With both switches up the device will amplify telephone conversations, for which purpose the cord at the left should be connected to the telephone as explained in the text

THE advent of the midget radio came at a time when the writer was having difficulty in finding a satisfactory hearing aid. It was therefore decided to see what could be done to adapt the portable radio to use as a hearing aid.

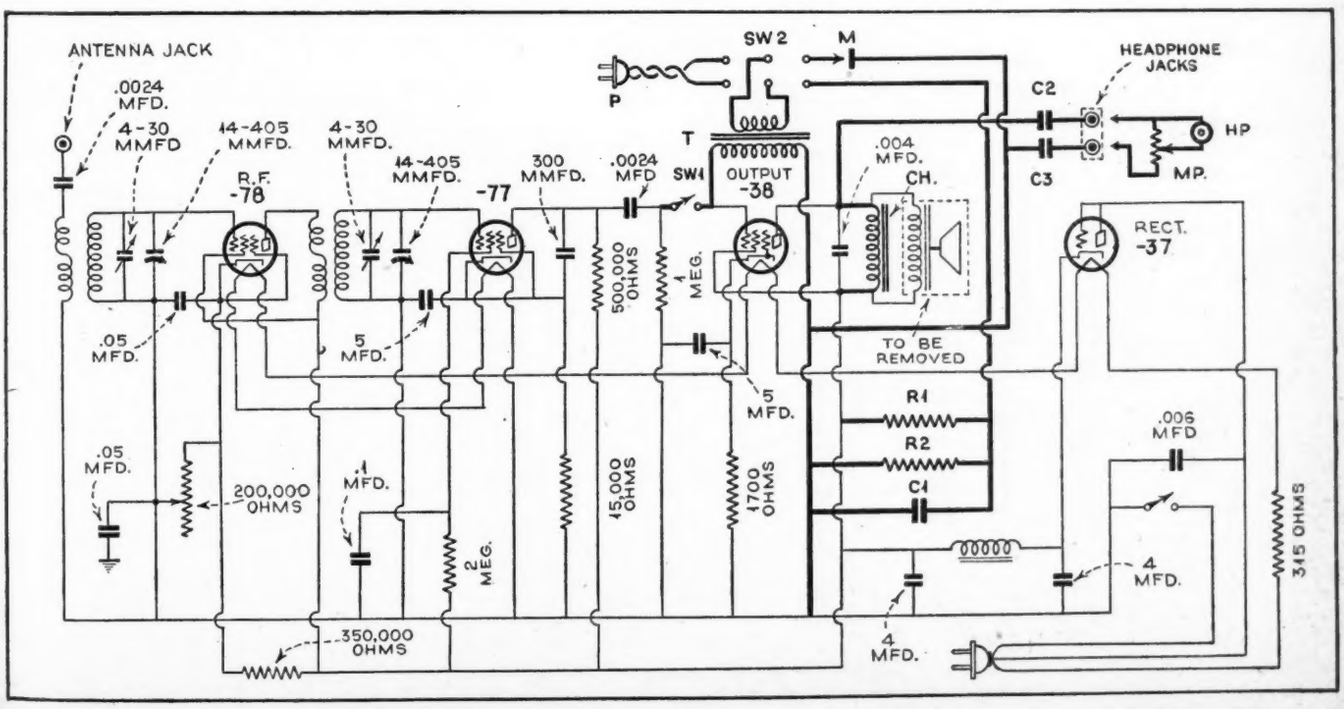
As the first step a microphone, taken from an old pocket-type hearing aid, was installed in the space occupied by the loudspeaker, which had been removed, and a headphone was connected in its place in the circuit. Presto! a hearing aid comparable to many costing considerably more was mine; and the radio was also available when desired.

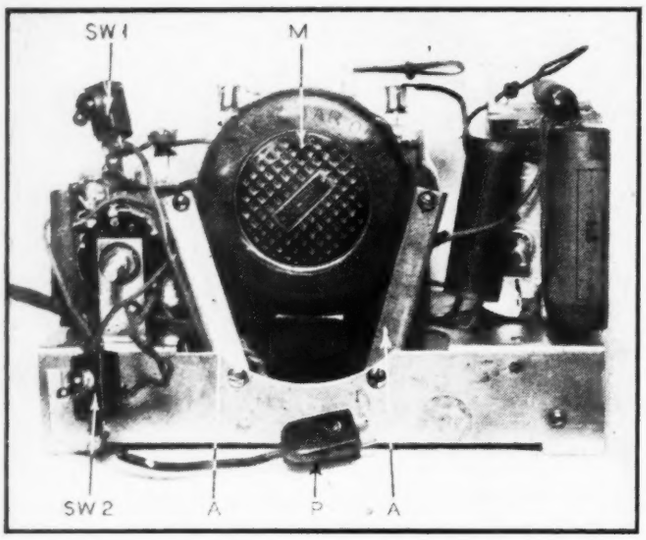
The fidelity of reproduction with the "hearing aid" type microphone, although equal to that of many commercial hearing aids, was poor as compared to the reproduction of the radio programs in the same headphone and using the same radio circuit and tubes. A carbon microphone of the type used in radio work was therefore obtained and substituted for the first microphone. A great improvement in tone quality was at once apparent and although the output was much lower, speech was so much clearer that the "hearing aid" type microphone was definitely discarded.

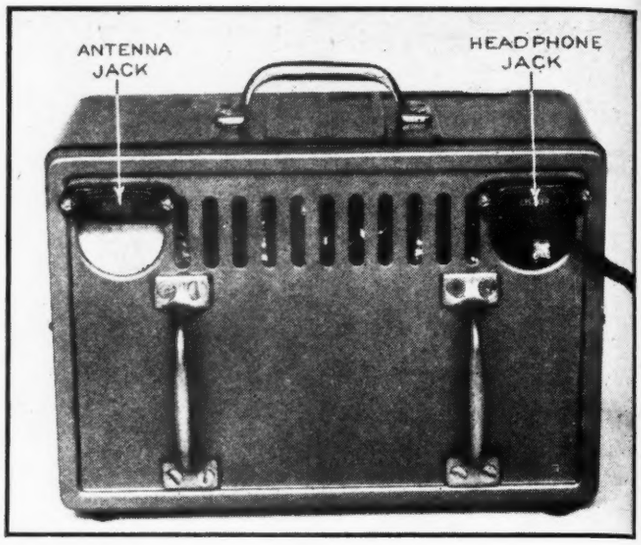
After a considerable number of experiments had been made, various improvements were worked out and the writer is now able to present the details of such an outfit. If the instructions are carefully followed, the results will be satisfactory even for those with severe hearing losses. The writer has about twenty per cent of normal hearing remaining in one ear, the other entirely gone, but the device to be described enables him to carry on a con-

THE ORIGINAL CIRCUIT AND CHANGES

Figure 4. The original circuit is shown in light lines. The additions are shown in heavy lines. The speaker and its coil are the only parts to be discarded







THE REVAMPED CHASSIS

Figure 1 (above, left) and Figures 2 and 3 (below) indicate by means of letter symbols the parts that have been added to the original G. E. midget chassis. The rear view above, right, shows the locations of the antenna and headphone jacks, also the positions of the brackets installed to accommodate the line cord, headphone extension cord, etc., when carrying the instrument

versation from any position in a room with ease and provides clear and natural results—both as a hearing aid and as a radio. Also, means for amplifying a telephone conversation are incorporated.

Since something that will stand carrying around was desired a General Electric Model M-40 was selected. This is a four tube a.c.-d.c. set, which has a steel case.

Because of the extremely close quarters, the alterations will be explained in more detail than is customary.

Cut the aerial (which comes attached to this radio set) about six inches from the case. Take the radio from the case and remove the loudspeaker. The loudspeaker cutout in the chassis has a projecting cutout at the rear into which the microphone transformer (T) will just fit. First, however, remove the transformer from the case and take off the transformer terminal screws. Solder insulated radio hookup wires, each 1 foot long, directly to the leads in the place of the terminal screws. Replace the case, making sure the soldered ends are well taped and secure. Bring the leads out of the holes where the terminal screws were. To maintain the insulation here is essential as the transformer primary is to be part of the telephone circuit when the device is used as a telephone amplifier and the telephone circuit must not even be grounded, much less be allowed to come in contact with any of the high-voltage leads.

THIS article points the way to a profitable sideline for servicemen in converting a standard midget radio to serve as both radio and hearing aid; a combination which will appeal to the hard-of-hearing public.

Mount the transformer at the rear of the square portion of the speaker cutout. Bend such wires out of the way as may be necessary to get the transformer in place and fasten the transformer by drilling, and tapping two 10/32 holes, 1½ inches from the front of the chassis and 3/16 inch from each side of the cutout. Mount the transformer with its base below the subpanel, two ⅜ inch by 1½ inch tubular brass spacers being used between the sub-panel and transformer screw lugs. Two 10/32 round-head screws, 2 inches long, hold the assembly.

On top of this transformer the output choke (Ch) is mounted. Use one of impedance suitable for a pentode tube, and with dimensions not exceeding 1¼ inches thick, 1½ inches high and 1¾ inches long. This will fit the space provided. Before mounting this choke, wrap it with two or three turns of friction tape and make a 1/32 thick fiber insulator 1½ inches long by 1½ inches high with a cutout of 1 inch by 1⅛ inches to form a "U" shaped insulator with legs ⅜ inch wide. Slip the insulator legs between the tape and core of the choke on the side that will be towards the front of the chassis, so it will insulate the microphone center contact from the choke core.

Fasten the choke in place with a brass angle, made from 1/16 inch by ⅜ inch by 1 inch stock, bent at ⅜ inch from one end to a right angle. Drill and tap a 6/32 inch hole in the center of the short side and fasten in place on the front of the (*Continued on page* 121)

FIGURE 2

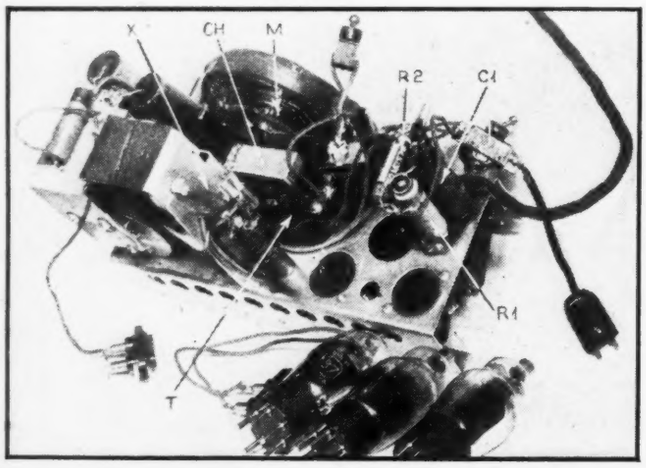
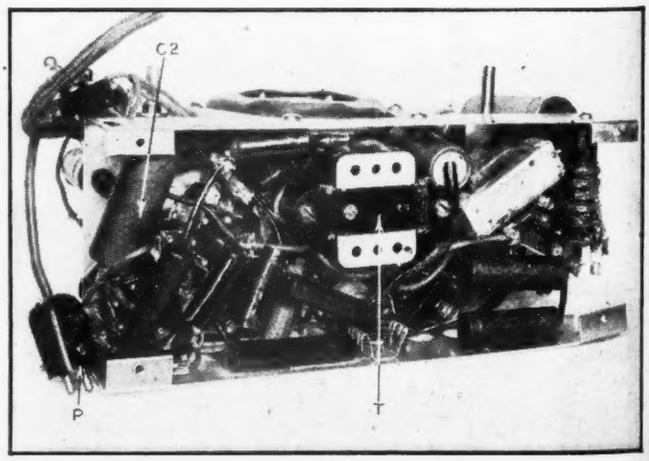


FIGURE 3



MORE NOTES ON R. F. AMPLIFIERS

for Amateur Transmitters

The subject of radio-frequency power amplifiers has not been given the attention it deserves in technical literature. The author, owner and operator of W2BRB, gives added information on the design and adjustment of amplifiers and some dope on frequency doublers

Edward M. Glaser

Part Three

IN the previous installment, for purposes of discussion, we have been using an oscillator to feed the amplifier stage. Another amplifier (such as a buffer stage) could have been used and the points covered on neutralizing and power transfer would hold equally well. The actual number of straight amplifier stages used will depend upon the oscillator power and the output expected from the power amplifier (the final stage) and also upon the type of amplifier operation—that is, whether Class B or C operation is wanted, the latter being necessary when using Heising modulation. It has been the writer's experience with a great variety of crystal-controlled and ordinary "master-oscillator" type transmitters that a power step-up of about 10 may be expected for each stage feeding a Class B amplifier. The step-up will be somewhat greater than this on the low frequencies (the 1750 kc. band) while it will probably be a lot less on the 30 and 60 Mc. bands, depending a great deal upon the type of tubes used, the method of coupling, and whether a single tube, push-pull or parallel arrangement is used. While an abundance of exciting voltage is desirable, it is often economical to supply just enough for proper operation. Sometimes a stage of amplification might be omitted by carefully adjusting all circuits for maximum efficiency—by working at the extreme right part of the curves of Figure 1 and boosting the plate voltage until the tube works at the proper temperature.

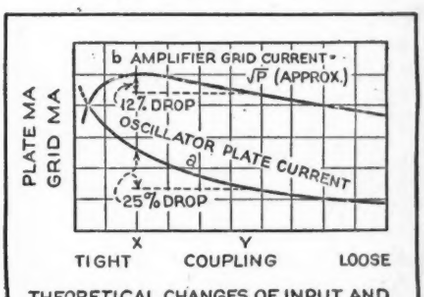
When an amplifier hasn't enough exciting voltage, it cannot be made to draw normal plate current with the proper amount of bias. To get normal input it is necessary to decrease the C voltage in which case the amplifier is no longer operating as a class B stage (it is approaching Class A, operation) and the efficiency therefore, cannot be high; hence, the output will be small and the tube will run hot. The reader must bear in mind the fact that it is necessary to have the amplifier properly loaded (which is another way of saying that the tube must work into the proper load impedance) in order that the tube may draw normal plate current. If the tube be but lightly loaded, it will not draw normal plate current no matter what the exciting voltage may be. On the other hand, if the tube is too heavily loaded—the coupling too close—the tube may draw over normal plate current with less than normal exciting voltage and we might think that it is getting enough r.f. input. In this case, however, we are again working at the left hand part of the curves of Figure 1 and Figure 2 so our output will be very low and our tube very hot.

All through the article, the author has been talking about Class B and Class C bias. Class B bias has already been explained as that voltage necessary to reduce the plate current to zero when no exciting voltage is applied. Class C grid bias is a voltage greater than that necessary to produce cut-off and, when using 'phone, the Class C bias is usually taken as exactly twice the Class B bias. Now it may not always be convenient to determine the proper bias experimentally in which case it may be calculated by using the formula, Class B bias = E_b/μ, which has already been explained.

While screen-grid tubes require less C bias than 3- element tubes (because of their higher μ), the power necessary to excite them is about the same. With small tetrodes and pentodes, the author has found that it takes less power input for a given output to operate these tubes, notably the pentodes, than it does to operate triodes. This means that, from a power amplification standpoint, it is a little better to use the screen-grid type of tube. When we are amplifying at the same frequency, it is absolutely imperative that we neutralize a triode whereas it is seldom that we must introduce neutralization when we are using screen-grid tubes. This, rather than a small saving of power, is the great advantage of using tetrodes and pentodes.

Getting back to our amplification ratios, it was stated that the figures given were for Class B amplifiers, that is, working into a Class B amplifier. (The tube feeding the amplifier might be working as a Class C amplifier). If we want to use 'phone, the modulated stage will have to be run as a Class C amplifier which requires twice the C bias and therefore twice the exciting voltage. Since voltage is proportional to the square root of the power, twice the voltage means FOUR TIMES THE POWER is needed to excite the Class C stage. This, of course, assumes that the input impedance remains constant. If we use 'phone, then, our power amplification in the stage pushing the modulated tube will be only 2.5 times if it was 10 times when feeding a Class B stage for c.w. work. This is a very im-

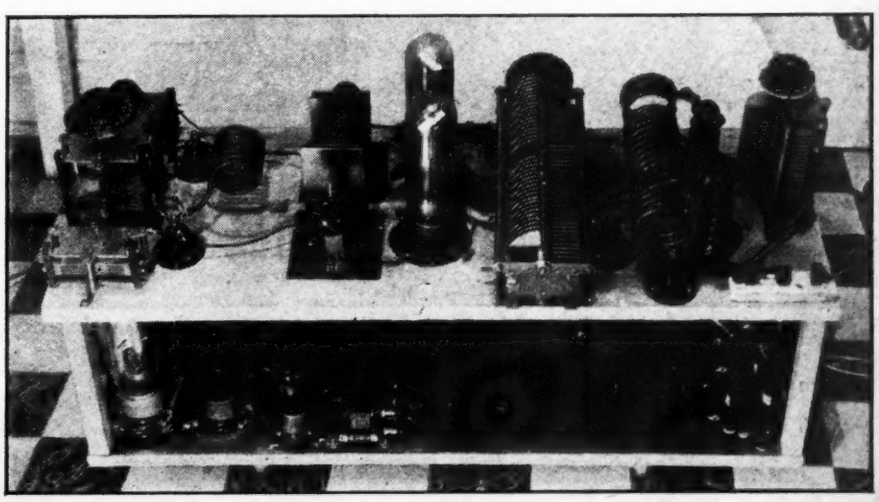
CALCULATED CURVES



THEORETICAL CHANGES OF INPUT AND OUTPUT CURRENT WITH VARIATION IN COUPLING
FIG. 1

PUSH-PULL POWER AMPLIFIER

This amplifier is an example of an efficient push-pull design for amateur use



portant point to remember when building a c.w. transmitter that might, at some future time, be used for 'phone work. More will be said of this subject in the paragraph on design.

So far in this article we have been considering only successive r.f. amplification at the same frequency. Most amateurs desire to operate their stations in several of the available frequency bands so that it is necessary to have some means of shifting from one band to another. When using a self-controlled oscillator, changing the oscillator and amplifier coils and, perhaps, the antenna coil will provide a simple and effective wave-change scheme. When using crystal-control, however, it is usually not so easy. If we shift from 1.75 mc. to 4 mc. we might plug in a different crystal together with the family of coils as before. We may even follow this procedure for a 7 mc. shift but there we stop. It is impractical to use crystals at higher frequencies than this. Then, again, all of us cannot afford to have a flock of crystals lying around waiting to serve us at different frequencies. So we come into the realm of frequency multipliers where we shall remain for a few paragraphs.

In order to explain how a frequency multiplier works, we find it handy to borrow a fact from mathematics which goes something like this: any complex wave form may be resolved into a number of simple sine wave components. In Class B and C amplifiers, the wave form of both grid and plate currents is not sinusoidal but may have a number of different shapes. This is due to the fact that the tube operates over only a part of the cycle of the input voltage which causes a sudden pulse of plate current to flow whenever the grid is positive. Now in the grid circuit of an r.f. amplifier appears this complex wave form which is made up of a number of simple sine waves *and these sine waves include the fundamental frequency and all the harmonics*—to infinity!! Therefore, if we tune the plate circuit to any one of these harmonic waves (or frequencies), we have a frequency multiplier, the output frequency of which corresponds to the harmonic to which we have tuned! Practically, however, it is unreasonable to go beyond the third harmonic (multiplying the frequency by 3) because the efficiency drops off rapidly and we get but little power output on the new frequency. We therefore will talk about frequency doublers and triplers.

Any tube will work as a frequency multiplier. It is not necessary to neutralize triodes when so used because there is relatively very little feedback due to the wide separation of frequencies. However, regeneration is decreased and stability increased when neutralizing is employed so there is no objection to its use other than the fact that the L/C ratio is reduced due to the loading effect of the neutralizing condenser. When the same stage is used both as a straight amplifier and multiplier, it is convenient to neutralize it at the lower frequency and let it remain that way when doubling.

A frequency multiplier should operate as a Class C amplifier with its plate, grid and input voltages increased. The stage feeding the multiplier should have a high L/C tank circuit. Perhaps it would be a good idea to enumerate the main points in getting a multiplier stage to operate efficiently:

(1) Give the multiplier stage as much excitation as possible without sacrificing efficiency of the previous stage.

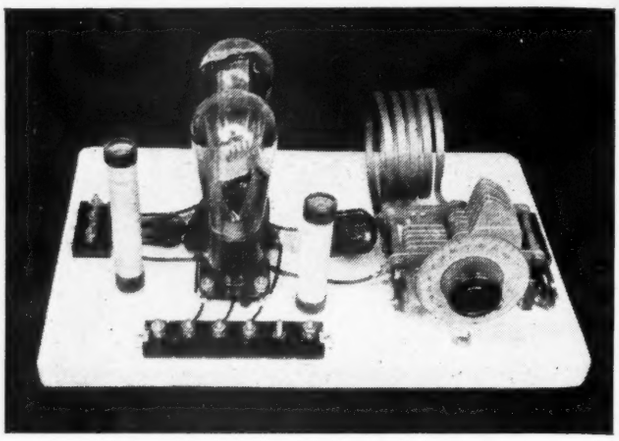
(2) Use a high plate voltage with reduced plate current for a given number of watts input. (The author suggests 750 volts at about 55 ma. for a 210 operating at 7 mc.; lower voltage for higher frequencies).

(3) Add "C" bias until the tube operates with the plate just turning color.

(4) Couple to amplifier in accordance with information previously given and the efficiency should be at least 40% on the second harmonic and 30% on the third.

Screen-grid tubes operate well as multipliers but, for the same power, they are much more expensive than triodes and, therefore, much less popular among amateurs and experimenters. Since triodes do not have to be neutralized, there is nothing gained by using tetrodes. The author made some tests comparing the 210, 245 and 247 pentode as frequency doublers. With 300 volts and less, the pentode gave the greatest output with the other tubes about tied. At 400, the 210 and the pentode vied for first place leaving the low μ 45 behind. As it is not a good policy to exceed this voltage with the receiving tubes, the 210 unquestionably is better at voltages greater than 400. The UX841, high μ sister of the 210, is superior to the '10 for frequency multiplying and a greater efficiency should result when using it.

Since the efficiency of an average doubler stage is only about 40% it is usually more (*Continued on page* 117)



FREQUENCY DOUBLER

This is the author's experimental push-pull input, parallel output frequency doubler, used at W2BRB

EXPERIMENTAL CURVES

Figure 2. These curves show the same relations as those in Figure 1, but they were obtained by actual measurement. Note how they agree with the theoretical curves

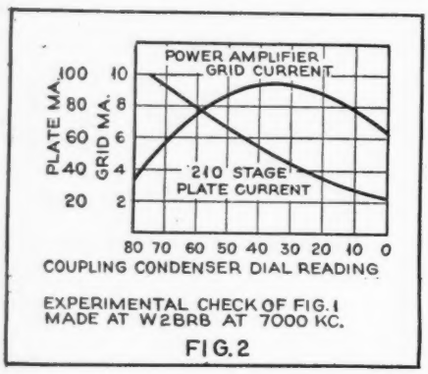


FIG. 2

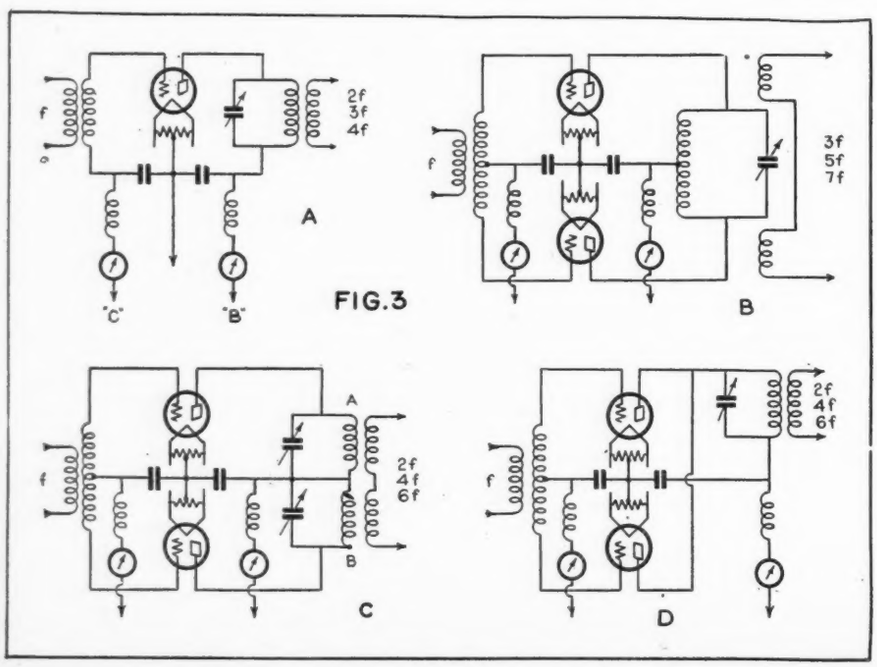


FIG. 3

SHORT-WAVE STATION LIST

(Giving Wavelength, Frequency, Call, Location and Service)

Meters	Kc	Call	Location	Service and Schedule
13.44	22,300	GBU	Rugby, England	Phone
13.86	21,625	KFZ, KFY	Little America	Phone
13.88	21,600	KFZ, KFY	Little America	Phone
13.92	21,540	W8XK	E. Pittsburgh, Pa.	Broadcast 7 A.M.–2 P.M. daily
13.94	21,515	KFZ, KFY	Little America	Experimental; phone
13.97	21,470	GSH	Daventry, England	Broadcast
14.01	21,420	W2XDJ	Deal, N. J.	Experimental
14.01	21,420	WKK	Lawrenceville, N. J.	Phone to Argentina 8 A.M.–4 P.M.
14.01	21,420	WLO	Lawrence, N. J.	Transatlantic phone
14.17	21,160	LSL	Buenos Aires, Argentina	Phone to Europe, mornings
14.18	21,140	KRI	Manila, P. I.	Phone
14.19	21,130	LSM	Buenos Aires, Argentina	Phone, sometimes broadcast
14.24	21.060	KWN	Dixon, Calif.	Phone
14.24	21,060	WKA	Lawrenceville, N. J.	Phone to England, 8 A.M.–4 P.M.
14.27	21,020	LSN	Buenos Aires, Argentina	Phone to New York
14.28	21,000	OKI	Podebrady, Czechoslovakia	Phone
14.41	20,820	KSS	Bolinas, Calif.	Phone
14.47	20,780	KMM	Bolinas, Calif.	Phone
14.46	20,730	LSY	Buenos Aires, Argentina	Phone 10 A.M.–2 P.M.
14.50	20,680	LSX	Buenos Aires, Argentina	Phone to U. S.
14.50	20,680	LSN	Buenos Aires, Argentina	Phone to Europe after 10.30 P.M
14.53	20,640	FSR	Paris, France	Paris-Saigon phone
14.54	20,620	PMB	Bandoeng, Java	Phone to Holland
14.72	20,380	GAA	Rugby, England	Phone to ships and LSN
14.88	20,140	DWG	Nauen, Germany	Phone to Argentina and tests
14.97	20,028	DHO	Nauen, Germany	Phone
14.97	20,040	OPL	Leopoldville, Belgian Congo	Phone to Belgium
15.01	19,980	KAX	Manila, P. I.	Phone to Dixon
15.04	19,950	DIH	Nauen, Germany	Phone
15.08	19,900	LSG	Buenos Aires, Argentina	Phone to Ste. Assise
15.10	19,850	WMI	Deal, N. J.	Phone
15.12	19,840	FTD	Ste. Assise, France	Phone
15.14	19,820	WKN	Lawrenceville, N. J.	Phone to England 8 A.M.–4 P.M.
15.21	19,720	EAQ	Madrid, Spain	Phone to S. America
15.24	19,680	CEC	Santiago, Chili	Phone
15.38	19,500	LSQ	Buenos Aires, Argentina	Phone, sometimes broadcast
15.45	19,400	FRO, FRE	Ste. Assise, France	Phone
15.57	19,260	PPU	Rio de Janeiro, Brazil	Phone to France
15.58	19,240	DFA	Nauen, Germany	Phone to XDA
15.60	19,220	WNC	Deal, N. J.	Transatlantic phone
15.60	19,220	WKF	Lawrenceville, N. J.	Phone to England; 8 A.M.–4 P.M.
15.62	19,200	ORG	Brussels, Belgium	Phone
15.76	19,020	WKW-W2XBJ	Rocky Point, L. I.	Tests
15.82	18,960	LSR	Buenos Aires, Argentina	Phone
15.87	18,892	WDS	Rocky Point, L. I.	Phone
15.90	18,890	ZSS	Klipheuvel, S. Africa	Phone to England
15.94	18,820	PLE	Bandoeng, Java	Phone; Wed., Thu. 6–8 P.M. music tests
16.06	18,680	OCI	Lima, Peru	Tests
16.10	18,620	GBJ	Bodmin, England	Phone to Montreal
16.11	18,620	GBU	Rugby, England	Phone to New York
16.12	18,600	PDM	Kootwijk, Holland	Phone
16.27	18,440	HJY	Bogota, Colombia	Phone to CEC and LSR
16.29	18,400	PCK	Kootwijk, Holland	Phone
16.33	18,370	PMC	Bandoeng, Java	Phone
16.35	18,340	ZLW	Wellington, N. Z.	Phone to Australia, irr.
16.35	18,350	WND	Deal Beach, N. J.	Phone
16.36	18,340	WLA	Lawrenceville, N. J.	Transatlantic phone
16.38	18,310	FZS	Saigon, Indo-China	Phone to Paris
16.38	18,310	GBS	Rugby, England	Phone to New York
16.39	18,295	YVQ	Maracay, Venezuela	Phone
16.44	18,240	FRO-FRE	Ste. Assise, France	Phone
16.47	18,220	KUS	Manila, P. I.	Phone
16.49	18,170	CGA	Drummondville, Que.	Phone to England
16.53	18,145	PMC	Bandoeng, Java	Phone to Kootwijk, 3.10-9.20 A.M.
16.55	18,110	LSY	Buenos Aires	Phone, Broadcast
16.56	18,105	W9XAA	Chicago, Ill.	Exp.
16.63	18,040	KQR	Bolinas, Calif.	Phone
16.65	18,020	KQJ	Bolinas, Calif.	Phone
16.67	18,000	KQG	Bolinas, Calif.	Phone
16.69	17,890	KQZ	Bolinas, Calif.	Phone
16.80	17,850	LSN	Buenos Aires, Argentina	Phone: sometimes broadcast
16.80	17,850	PLF	"Radio Malabar," Bandoeng, Java	Phone
16.80	17,850	W2XAO	New Brunswick, N. J.	Exp.
16.82	17,830	PCV	Kootwijk, Holland	Phone to Java
16.84	17,800	XGOX	Nanking, China	Broadcast
16.86	17,790	GSG	Daventry, England	Broadcast
16.87	17,780	W9XAA	Chicago, Ill.	Broadcast; tests
16.87	17,780	W8XK	E. Pittsburgh, Penna.	Broadcast, relays KDKA
16.87	17,780	W3XAL	Bound Brook, N. J.	Exp., relays WJZ
16.88	17,775	PHI	Huizen, Holland	Broadcast mornings; during summer months
16.88	17,760	DJE	Koenigswusterhausen, Ger.	Phone
16.92	17,719	HSP	Bangkok, Siam	Phone
17.00	17,640	GFWV	S. S. Majestic	Phone
		GLSQ	S. S. Olympic	Phone
		GDLJ	S. S. Homeric	Phone
		GMJQ	S. S. Belgenland	Phone
		GTSD	S. S. Monarch of Bermuda	Phone
		GKFY	S. S. Minnetonka	Phone
		GMBJ	S. S. Empress of Britain	Phone
17.02	17,620	KFZ, KFY	Little America	Phone
17.04	17,600	KFZ, KFY	Little America	Phone
17.12	17,512	DFB	Nauen, Germany	Phone
17.24	17,400	J1AA	Tokio, Japan	Phone to Australia
17.34	17,300	W3XL	Bound Brook, N. J.	Exp.; relays WJZ Fridays
17.34	17,300	W8XL	Dayton, Ohio	Exp.
17.34	17,300	W6XAJ	Oakland, Calif.	Exp.
17.34	17,300	W2XCU	Ampere, N. J.	Exp.
17.34	17,300	VE9BY	London, Ont.	Exp., irregular.
17.36	17,270	KFZ, KFY	Little America	Phone
17.37	17,260	DAF	Norddeich, Germany	Phone
17.52	17,120	WOO	Deal, N. J.	Phone
17.52	17,120	W2XDO	Ocean Gate, N. J.	Exp.
17.55	17,080	GBC	Rugby, England	Phone
18.00	16,665	DAN	Norden, Germany	Tests with ships
18.36	16,330	WLK	Lawrence, N. J.	Phone
18.39	16,305	PCL	Kootwijk, Holland	Phone to Bandoeng from 7 A.M
18.39	16,300	WLO	Lawrence, N. J.	Phone to England
18.47	16,240	KTO	Manila, P. I.	Phone
18.50	16,200	FZR	Saigon, Indo-China	Phone to Paris
18.55	16,162	PSA	Rio de Janeiro, Brazil	Phone
18.56	16,150	GBX	Rugby, England	Phone
18.68	16,060	NAA	Arlington, Va.	Time: 11.57—noon
18.71	16,030	KKP	Kauhuku, Hawaii	Phone to KWO
18.77	15,985	KQH	Kauhuku, Hawaii	Phone
18.80	15,950	PLG	Bandoeng, Java	Phone, afternoons
18.90	15,860	FTK	Ste. Assise, France	Phone to Saigon
19.09	15.760	JYT	Tokio, Japan	Exp. and broadcast
19.36	15,490	KEM	Bolinas, Calif.	Phone
19.39	15,475	KKL	Bolinas, Calif.	Phone
19.40	15,460	KKR	Bolinas, Calif.	Phone
19.44	15,430	KWE	Bolinas, Calif.	Phone
19.46	15,410	KWO	Dixon, Calif.	Phones Hawaii, 2–7 P.M.
19.54	15,344	KWU	Dixon, Calif.	Phone to Hawaii, 2–7 P.M.
19.56	15,330	W2XAD	Schenectady, N. Y.	Broadcast; Mo., We., Fri., 3–4 P.M., Sunday 2–4 P.M.
19.55	15,340	CT1AA	Lisbon, Portugal	Experimental
19.60	15,300	OXY	Lyngby, Denmark	Experimental
19.61	15,295	CP5	La Paz, Bolivia	Phone
19.65	15,270	W2XE	Wayne, N. J.	Broadcast; relays WABC
19.67	15,250	W1XAL	Boston, Mass.	Broadcast
19.68	15,243	FYA	Pontoise, France	Broadcast; 5–8 A.M.
19.72	15,210	W8XK	E. Pittsburgh, Penna.	Broadcast, relays KDKA
19.73	15,200	DJB	Zeesen, Germany	Broadcast
19.76	15,190	VE9BA	Montreal, Que.	Exp.
19.81	15,140	GSF	Daventry, England	Broadcast
19.81	15,130	VE9DN	Montreal, Que.	Exp.
19.83	15,120	J1AA	Tokio, Japan	Broadcast, irregular, mornings
19.83	15,123	HVJ	Vatican City, Italy	Broadcast; 5.00–5.15 A.M. daily
19.85	15,110	DJL	Konigswusterhausen, Ger.	Broadcast
19.85	15,104	RAU	Tashkent, U. S. S. R.	Broadcast
19.90	15,075	TI4NRH	Heredia, Costa Rica	Broadcast
19.92	15,051	WNC	Hialeah, Florida	Phone to Panama and S. America
19.99	15,000	CM6XJ	Central Tuninucu. Cuba	Broadcast, irregular
20.04	14,980	KAY	Manila, P. I.	Phone to Dixon; 8 A.M.
20.08	14,930	HJB	Bogota, Colombia	Phone
20.23	14,706	WKU-W2XBJ	Rocky Point, L. I.	Tests; daytime
20.42	14,690	PSS	Rio de Janeiro, Brazil	Phone
20.50	14,620	XDA	Mexico City	Phone
20.60	14,550	HBJ	Geneva, Switzerland	Phone
20.65	14,530	WMN	Lawrenceville, N. J.	Phone to England
20.65	14,530	LSN	Buenos Aires	Phone
20.65	14,530	LSA	Buenos Aires, Argentina	Phone to England
20.69	14,545	RXC	Panama City	Phone to Florida
20.70	14,480	LSN	Buenos Aires, Argentina	Phone
20.70	14,480	GBW	Rugby, England	Phone to New York
20.73	14,460	WMF	Lawrenceville, N. J.	Transatlantic phone
20.80	14,420	VPD	Suva, Fiji Islands	Phone
20.98	14,290	YV2AM	Maracaibo, Venezuela	Experimental
21.17	14,150	KKZ	Bolinas, Calif.	Phone
21.52	13,950	YO1	Bucharest, Rumania	Broadcast
21.53	13,925	WIK	Rocky Point, L. I.	Phone
21.63	13,860	WIY-W2XBJ	Rocky Point, N. J.	Tests
21.72	13,811	SUZ	Abu Zabal, Egypt	Phone to England
21.77	13,780	KKW	Bolinas, Calif.	Phone
21.82	13,740	CGA	Drummondville, Que.	Phone
21.90	13,690	KKZ	Bolinas, Calif.	Tests, irregular
21.92	13,685	HAT	Szekesfehervar, Hungary	Broadcast
22.02	13,610	JYK	Tokio, Japan	Experimental; broadcast
22.06	13,591	GBC	Rugby, England	Phone to Canada and ships
22.26	13,480	WAJ	Rocky Point, N. Y.	Tests
22.38	13,400	WND	Deal Beach, N. J.	Transatlantic phone
22.40	13,380	WMA	Lawrenceville, N. J.	Phone
22.55	13,340	CGA	Drummondville, Que.	Phone to England
22.61	13,260	KFZ, KFY	Little America	Phone
22.64	13,245	KFZ, KFY	Little America	Phone
22.66	13,240	KBJ	Manila, P. I.	Phone
22.67	13,230	KFZ, KFY	Little America	Phone
22.68	13,220	GFWV	S. S. Majestic	Phone
		GLSQ	S. S. Olympic	Phone
		GMJQ	S. S. Belgenland	Phone
		GDLJ	S. S. Homeric	Phone
		VTSX	S. S. Monarch of Bermuda	Phone
		GKFY	S. S. Minnetonka	Phone
		GMBJ	S. S. Empress of Britain	Phone
22.71	13,200	KFZ, KFY	Little America	Phone
22.74	13,185	KFZ, KFY	Little America	Phone
22.93	13,074	J1AA	Kemikawa-Cho, Japan	Phone
23.00	13,040	DDAC	S. S. Europa	Phone
		DDAS	S. S. Bremen	Phone
		DDBR	S. S. Berlin	Phone
		DDCB	S. S. Columbus	Phone
		DDCG	S. S. Resolute	Phone
		DDCP	S. S. Cap Polonio	Phone
		DDDT	S. S. Deutschland	Phone
		DDDX	S. S. Hamburg	Phone
		DDEA	S. S. Cap Arcona	Phone
		DDED	S. S. New York	Phone
		DDFF	S. S. Reliance	Phone
		DDFT	S. S. Oceana	Phone
		DDNY	S. S. Albert Ballin	Phone
23.38	12,830	CNR	Rabat, Morocco	Broadcast; 7.30-9 A.M., Sun
23.45	12,795	IAC	Coltana, Italy	Tests

(To be continued next month)

PIONEERS

Official RADIO NEWS Listening Post Observers

LISTED below by States are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner.

United States of America:

Alabama, J. E. Brooks; **California,** E. G. DeHaven, C. H. Canning, E. S. Allen, A. E. Berger, Ralph Leavitt; **Colorado,** Wm. J. Vette, F. Erich Bruhn; **Florida,** E. M. Law, James F. Dechert; **Georgia,** James L. Davis, C. H. Armstrong, Guy R. Bigbee; **Idaho,** Bernard D. Starr; **Illinois,** Phillip Simmons, E. Bergeman, Robert L. Weber, Floyd Waters; **Indiana,** Freeman C. Balph, J. R. Flannigan; **Iowa,** J. Harold Lindblom; **Kansas,** C. W. Bourne, Wm. Schumacher; **Kentucky,** Wm. A. McAlister, George Krebs; **Maine,** R. I. Keeler; **Maryland,** Howard Adams, Jr., James W. Smith; **Massachusetts,** Armand A. Boussy, J. Walter Bunnell, Harold K. Miller, Donald Smith, Elmer F. Orne, Arthur Hamilton, Roy Sanders; **Minnesota,** Dr. G. W. Twomey; **Mississippi,** Dr. J. P. Watson, Mrs. L. R. Ledbetter; **Missouri,** C. H. Long; **Nebraska,** P. H. Clute, G. W. Renish, Jr., Harold Hansen; **New Hampshire,** P. C. Atwood, A. J. Mannix; **New Jersey,** William Dixon, R. H. Schiller, William F. Buhl; **New Mexico,** G. K. Harrison; **New York,** R. Wright, I. H. Kattell, Donald E. Bame, Albert J. Leonhardt; **Nevada,** Don H. Townsend, Jr.; **North Carolina,** H. O. Murdoch, Jr., W. C. Couch, E. Payson Mallard; **North Dakota,** Dr. F. C. Naegeli; **Ohio,** Oker Radio & Electric Shop, R. W. Evans, C. H. Skatzes, Donald W. Shields; Albert E. Emerson; **Oklahoma,** H. L. Pribble, Robert Woods; **Pennsylvania,** Edward C. Lips, K. A. Staats, C. T. Sheaks, George Lilley, John A. Leininger, F. L. Stitzinger, Hen F. Polm, Chas. Nick; **South Carolina,** Edw. F. Bahan; **Tennessee,** Charles D. Moss, Adrian Smith; **Texas,** Heinie Johnson; Bryan Scott; **Utah,** Harold D. Nordeen; **Vermont,** Joseph M. Kelley, Eddie H. Davenport; **Virginia,** Gordon L. Rich, G. Hampton Allison, D. W. Parsons; **Washington,** A. D. Golden, Glenn E. Dubbe, Chas. G. Payne; **West Virginia,** Kenneth Boord, R. E. Sumner; **Wisconsin,** Willard M. Hardell, Walter A. Jasiorkowski.

Applications for Official Observers in the remaining States should be sent in immediately to DX Corner.

S. W. TIME SCHEDULE

LAURENCE M. COCKADAY

THE 17th installment of the DX Corner for Short Waves includes a leading feature entitled "World Short-Wave Time Table" in which are listed the month's International Short-Wave Best Bets. This time table contains a list of short-wave stations logged during the last month in the RADIO NEWS Westchester Listening Post in Pelham as well as at other Official RADIO NEWS Listening Posts throughout the world. The schedule also contains a list of Station Locations, giving both wavelength, call letters and frequency. This month we have left out the Short-Wave Sure-Shots in order to make space for a greater number of official communications of station programs which follow. If our listeners really want the Short-Wave Sure-Shots reinstated rather than referring directly to the World Short-Wave Time Table, they should communicate with the Editor immediately.

Reception Conditions This Month

O.R.N.S.W.L.P.O.'s report the 25-meter band as the outstanding band during the past month. The 31-meter band has been good but there has been quite a lot of static on the 49-meter band. During the next thirty days we should see the same conditions holding true with further improvements of the 19-meter band.

Outstanding Short-Wave Reception Features

One of the outstanding features of short-wave reception has been the Seth Parker Expedition reports back-and-forth from KNRA. The Byrd broadcasts have been interesting but marred by spotty reception. The best and steadiest all-day-long reception features have been those from the Daventry and the Zeesen stations, not forgetting the Madrid station. Pontoise has been coming in with rather improved signal strength on the 25.6-meter wavelength at night.

PHI Transmissions

An official communication from station PHI at Huizen, Holland, states that their transmitter is on the air during the summer, from April to October, on a wavelength of 16.88 meters from 12:30 to 15:00 G.M.T. except Tuesdays and Wednesdays.

OXY Transmissions

An official communication from station OXY at Skamlebaek, on the western coast of the island of Zealand, Copenhagen, states that they are on the air on a wavelength of 49.5 meters (6060 kc.) with a power of 0.5 kw. The statement says that they may transmit from time to time on 31.6 and 19.6 meters. They rebroadcast the daily programs of Copenhagen and Kalundborg from 6 p.m. to about 11:30 p.m., G.M.T. On Sundays they broadcast afternoon services at 1:00 p.m., G.M.T., during the summer.

EAQ Transmissions

An official communication from station EAQ at Madrid, Spain, states that they are on the air on a wavelength of 30 meters with a power of 20 kw. from 22:30 to 24:00 G.M.T. except Saturdays when there is a special program from 17:00 to 19:00, G.M.T.

LCL Transmissions

An official communication from the short-wave station at Jeloy, states that the following wavelengths will be tried out during the next few months: 31.95 meters, (9540 kc.); 42.92 meters, (6990 kc.); 48.94 meters, (6130 kc.); 60.94 meters, (4920 kc.); 73.12 meters, (4100 kc.). They state that they do not know just what frequency will be used at any particular time. (This month's Time Table shows the frequencies on which they were last heard.)

CT1CT Transmissions

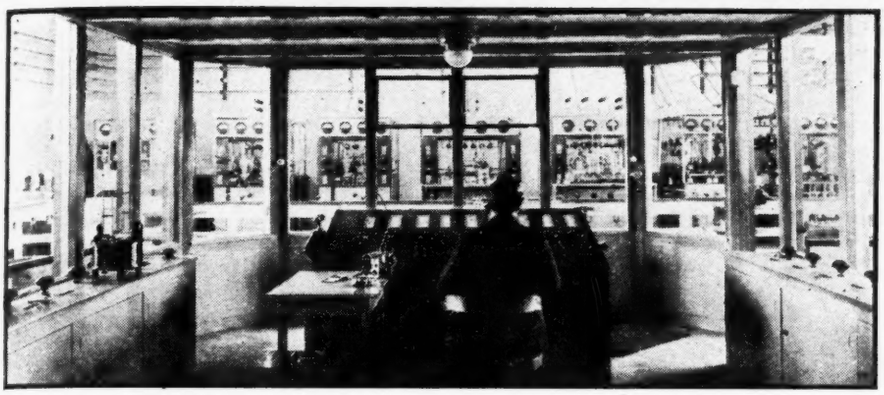
An official communication from station CT1CT at Lisbon, Portugal, states that they will be on the air on a wavelength of 24.83 meters, 12082 kc., with programs in English, French and Portuguese, on Sundays from 12:00 to 14:00, G.M.T., and on other days in the week from 21:00 to 00:00, G.M.T. They state that they are now transmitting on "Spring" time, which is an hour earlier.

W1XAL Transmissions

An official communication from the World Wide Broadcasting Corporation states that station W1XAL at Boston, Massachusetts, will be on the air, during the Spring and Summer schedules, on Mondays to Fridays from 6 to 6 p.m., E.S.T. and on Sundays from 10:45 a.m. to 11:30 p.m. and from 5:30 p.m. to 8:30 p.m. on 11790 kc. They use a power of 3 kw. at present. Later on they will add some daytime transmissions for the 15250 kc. frequency. From December to May they used a frequency of 6040 kc. They state that they are especially concerned with reception data from other continents.

"J1AA" Transmissions

An official letter from Toshitada Matsuyuki, chief engineer of the Short-Wave Station at Kemikawa-Cho, Chiba-ken, Japan, states that station "J1AA" uses the following calls: JYT, 15760 kc.; JYK, 13610 kc.; JYS, 9840 kc.; JYR, 7880 kc. Their service is a telephone and testing service with irregular relay broadcasting. Mr.



CONTROL BOARD AND R.F. AMPLIFIERS AT PHI, HOLLAND

Operator sitting at the control board of the famous Dutch station at Huizen, looking from the control room at a number of the r.f. amplifying states on separate panels and racks. The transmitter's power is 20 kw. The station is the result of pioneer work on the early station PCJ which came on the air in 1927.

Matsuyuki states that they are now relaying broadcast programs every day at JYR from 6:40 to 9:50 p.m., J.M.T.

British Empire Transmissions

An official communication from the British Broadcasting Company states that the Empire transmissions will be as shown in this month's World Short-Wave Time Table, with the following alternatives: GSC or GSA may be substituted for GSB; GSE may be substituted for GSD, or vice versa.

HJ5ABC Transmissions

An official communication from R. Angulo of station HJ5ABC states that this station at Cali, Colombia, transmits on a wavelength of 58 meters with a power of 30 watts. (They do not state any time schedule or any other information about the station except that they call it La Voz de Colombia.)

VE9DN Transmissions

An official communication from the Canadian Marconi Company states that station VE9DN, Montreal, Quebec, expects some alterations to the transmitter in the near future and they cannot say how their schedules will be shifted around at present.

The Russian Transmissions

An official communication from Radio Centre, Moscow, states that the two stations RV59 and RNE will be on the air at times as shown on our Time Schedule, during the summer months. They state, however, that the schedule is subject to change without notice.

CNR Transmissions

An official communication from Radio-Maroc states that station CNR at Rabat, Morocco, will be on the air on Sundays from 12:30 to 14:00, G.M.T. on a wavelength of 23.38 meters and from 19:30 to 22:00 on a wavelength of 32.26 meters. They relay the local broadcast station on 416 meters.

ORK-ORG Transmissions

An official communication from Direction des Radiocommunications at Bruxelles, Belgium, states that station ORK at Ruysselede, a suburb of Bruxelles, Belgium, transmits on a wavelength of 29.04 meters (10033 kc.) daily from 18:45 to 20:15, G.M.T., during the summer months and from 19:45 to 21:15, G.M.T., during the winter. Several experiments are being conducted on a channel of station ORG, 15.62 meters (19200 kc.) during the daytime, notably the broadcast of the funeral of the late King Albert I was transmitted over this station.

A Broadcast from W2XAF

The next program to be sent out from station W2XAF will be July 14th and on every alternate Sunday night following. This information is relayed to us through the courtesy of Mr. C. D. Wagoner of Schenectady, New York.

Listening Post Observers and Other Fans Please Note!

Listed below is some partial information regarding short-wave stations heard and recorded by our World-Wide Listening Posts. Can you supply the actual time schedules, actual wavelengths, correct frequencies, and any other information regarding them? There are some hard ones to pull in so get busy and try your skill in logging these stations and getting correct information about them. When you are satisfied you are correct, send this information in to the Editor. The list follows:

I3RO reported near 30 meters.

CQN, Macao, Portuguese China, heard on 49.8 meters. One listener reports their schedule as 6:30 to 7:30, E.S.T.

A short-wave station ZGE at Kuala, Lumpur, Federated Malay States, reported on 61.30 meters, the schedule believed to be 7 to 8 p.m., E.S.T.

Station YBG at Medan, Sumatra, reported as heard on 10425 kc. and also 2877 kc. The station schedule believed to be 10:45 to 11:45, M.S.T.

VUB, Bombay, reported on the air from 7 to 10 p.m., E.S.T.

HJ3ABF, Bogota, 6270 kc.

A reader asks, "Who is the Spanish speaking station on W2XAF's frequency?"

NS5Y reported as calling KCB.

JBN or JZN reported calling KWU.

HKF reported on 8100 kc. from 6 to 7 p.m.

YVQ, Maracay, Venezuela, reported on 13,300 kc., 2:45 p.m., E.S.T.

HJY reported on 18400 kc., 2:15 p.m., E.S.T.

LCL, Jeloy, Norway, first heard on 42.9 meters then later on 49.1 meters and now on 31.5 meters.

ZHI, Singapore, heard at 29.9 meters.

FZR, Indo-China, heard working Paris on 18.49 meters.

CFU reported on 52 meters.

HC1FG reported as heard.

TVD heard on 12060 kc. testing.

LAIG, Oslo, reported.

RKI, Moscow, reported on 19.94 meters.

HJ2ABC on 51.49 meters, 6 to 9 p.m.

ZFD, Hamilton, Bermuda, reported on 29.02 meters (10335 kc.) 21 to 21:45, G.M.T.

XETE reported testing on 49 meters, 55 meters, 70 meters and 80 meters, as well as on 31.2 meters.

CR7AA, Lourenco Marques, Portuguese

(*Continued on page* 90)

PIONEERS

Official RADIO NEWS Listening Post Observers

LISTED below by countries are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner:

Australia, C. N. R. Richardson, C. Arthur Matthews, A. H. Garth.

Brazil, W. W. Enete.

British Guiana, E. S. Christiani, Jr.

British West Indies, E. G. Derrick, Edela Rosa.

Canada, Douglas Wood, Jack Bews, W. H. Fraser, Robert Edkins, Charles Eugene Roy.

Chile, Jorge Izquierdo.

China, Baron P. D. N. von Hoyningen-Huene.

Cuba, Frank H. Kydd.

England, Kenneth Judd, C. L. Wright, John J. Maling, Alan Barber, Donald Burns, L. H. Plunkett-Checkemian, L. H. Colburn, Norman C. Smith and John Parkinson, Norman Nuttall, L. C. Styles, Frederick W. Gunn, R. Lawton, R. Stevens.

France, J. C. Meillon, Jr.

India, D. R. D. Wadia.

New Zealand, Dr. G. Campbell MacDiarmid, Kenneth H. Moffatt.

Philippine Islands, Victorino Leonen.

South Africa, C. McCormick, Mike Kruger.

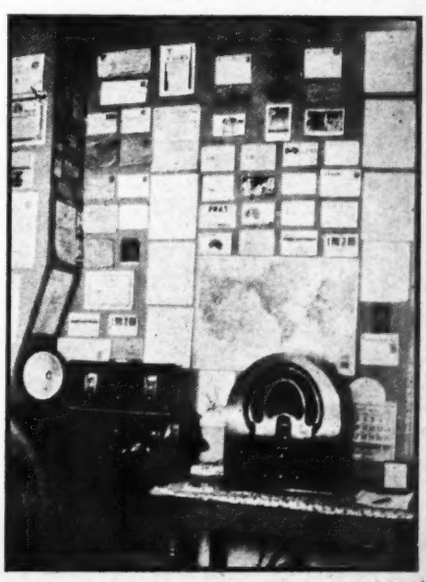
Switzerland, E. J. de Lopez, Dr. Max Hausdorff

Venezuela, Francisco Fossa Anderson.

Applications for Official Observers in the remaining countries should be sent in immediately to the DX Corner. Listeners outside of the United States who feel that they would like to serve in this capacity are hereby requested to file their applications as soon as possible before final appointments are made.

O.R.N.S.W.L.P.O. FOR OKLAHOMA

This is the ship-shape Listening Post of official RADIO NEWS *Short-Wave Observer Robert Woods, of Sand Springs, Oklahoma.*



WORLD SHORT WAVE TIME-TABLE

The schedule of short-wave broadcasting stations listed below includes only those that are received best in RADIO NEWS LISTENING POSTS. This new schedule is from 8 G. M. T. up to 07 G. M. T. Both wavelength and frequency are noted for each station. Station locations are found on page 90.

International Short-Wave "Best Bets"

Wavelengths in Meters	*Call Letters*	*Frequency in k.c.*
8 G. M. T. 3 A. M. E. S. T.		
30.4 Irregular	JYS	9840
31.3 Except Sun.	VK3LR	9579
31.5 Wed., Sat.	VK3ME	9510
38.0+	JYR	7880
48.9+	ZTJ	6122
70.2 Except Sun.	RV15	4273
9 G. M. T. 4 A. M. E. S. T.		
28.1	CEC	10670
30.4+	JYS	9840
31.3 Except Sun.	VK3LR	9579
31.3 Wed., Sat.	VK3ME	9510
38.0+	JYR	7880
48.9+	ZTJ	6122
49.9+ Ex. Tu., Th., Sat	RV59	6000
70.2 Except Sun.	RV15	4273
10 G. M. T. 5 A. M. E. S. T.		
19.8+ Except Sun.	HVJ	15123
30.4+	JYS	9840
31.2+ Sun.	VK2ME	9590
31.3 Except Sun.	VK3LR	9579
31.4+	LCL	9540
31.5 Wed., Sat.	VK3ME	9510
38.0+	JYR	7880
48.9+	ZTJ	6122
49.8+ Mon., Wed., Thur	ZHI	6012
50.2 Sun.	HVJ	5969
52.9+	XQAJ	5660
70.2 Except Sun.	RV15	4273
11 G. M. T. 6 A. M. E. S. T.		
13.9+	GSH	21470
14.2+	LSN	21020
16.8+	GSG	17790
19.7	DJB	15200
25.1+ Sun.	RNE	11924
30.4+	JYS	9840
31.2+ Sun.	VK2ME	9590
31.3 Except Sun.	VK3LR	9579
31.3+	DJA	9560
31.1+	LCL	9540
31.5 Wed., Sat.	VK3ME	9510
38.0+	JYR	7880
48.9+	ZTJ	6122
49.4+ Except Sun.	W8XAL	6060
49.8	CQN	6020
49.8+ Mon., Wed., Thu.	ZHI	6012
52.9+	XQAJ	5660
70.2 Except Sun.	RV15	4273
12 G. M. T. 7 A. M. E. S. T.		
13.9+	W8XK	21540
14.2+	LSN	21020
15.2+	IRW	19700
16.8+	GSG	17790
16.8+	W3XAL	17780
16.8+ Ex. Tues., Wed.	PHI	17775
19.6+	FYA	15243
19.7	W8XK	15210
19.7	DJB	15200
19.8	GSF	15140
19.8	VE9DN	15130
19.8+ Irregular	HVJ	15123
25.1+ Sun.	RNE	11924
25.3	GSE	11865
25.4+ Sun.	W1XAL	11790
26.8 Sun.	CT3AQ	11180
30.0	KAZ	9994
31.2 Sun.	VK2ME	9590
31.3+	W1XAZ	9570
31.3+	DJA	9560
31.4+	LCL	9540
31.8 Irregular	PLV	9415
48.9+	ZTJ	6122
49.0+	YV2RC	6112
49.0+ Except Sat., Sun.	VE9HX	6110
49.2 Fri., Sat.	VE9GW	6095
49.3+ Tues., Thurs.	OER2	6072
49.4+	W8XAL	6060
49.8+ Sun.	ZHI	6012
16 G. M. T. 11 A. M. E. S. T.		
13.9+	W8XK	21540
14.2+	LSN	21020
16.8+	W3XAL	17780
17.3+ Fri.	W3XL	17300
19.6+	W2XE	15270
19.7	W8XK	15210
19.8	GSF	15140
25.2	FYA	11900
25.3	GSE	11865
25.4+ Sun.	W1XAL	11790
26.8 Sun.	CT3AQ	11180
31.2+ Sun.	VK2ME	9590
31.3+	W1XAZ	9570
31.4+	LCL	9540
36.2+	CM6XJ	8265
40.5 Except Sun.	HJ3ABD	7402
46.5	HJ1ABB	6450
47.8 Tues., Fri.	HI1A	6272
48.9+	ZTJ	6122
49.0+ Sun.	YV2RC	6112
49.0+ Except Sat., Sun.	VE9HX	6110
49.2 Fri., Sat., Sun.	VE9GW	6095
49.3+ Irregular	W9XAA	6080
49.3+ Tues., Thurs.	OER2	6072
49.4+	VQ7LO	6060
49.4+	W8XAL	6060
49.8+ Sun.	ZHI	6012
50.2	HJ2ABC	5973
31.2+	W3XAU	9590
31.3+	W1XAZ	9570
31.4+	LCL	9540
31.5	GSB	9510
32.2+ Sun.	CNR	9294
36.2+	CM6XJ	8265
43.8+ Irregular	HAS	6840
47.5 Sun.	HIZ	6315
47.8	HI1A	6272
48.9+	ZTJ	6122
49.0+ Sun.	YV2RC	6112
49.0+ Except Sat., Sun	VE9HX	6110
49.2 Except Thurs.	VE9GW	6095
49.3+ Irregular	W9XAA	6080
49.3+ Tues., Thurs.	OER2	6072
49.3+ Sun	VE9CS	6070
49.4+	VQ7LO	6060
49.4+	W8XAL	6060
49.4+ Temporary	OXY	6060
49.8	DJC	6020
49.9+	RV59	6000
50.2+	HVJ	5969
73.0+ Except Mon.	HCJB	4107
20 G. M. T. 3 P. M. E. S. T.		
17.3+ Fri.	W3XL	17300
19.5+ Ex. Tu., Th., Sat.	W2XAD	15330
19.7	W8XK	15210
25.1+ Sun.	RNE	11924
25.2	FYA	11900
25.3+	W2XE	11830
25.4	12RO	11810
25.5	DJD	11760
25.5	GSD	11750
28.9+	LSX	10350
29.0+	ZFD	10335
29.0+	ORK	10330
30.5+ Irregular	IRM	9820
30.6 + Irregular	GCW	9790
31.2+	W3XAU	9590
31.3+	W1XAZ	9570
31.4+	LCL	9540
31.5	GSB	9510
32.2+ Sun.	CNR	9294
43.8+	HAS	6840
47.8 Sun.	HI1A	6272
48.9+ Sat.	ZTJ	6122
49.0+ Sun.	YV2RC	6112
49.0+ Except Sat., Sun.	VE9HX	6110
49.2	VE9GW	6095
49.3+ Irregular	W9XAA	6080
49.3+ Tues., Thurs.	OER2	6072
49.3+ Sun.	VE9CS	6070
49.4+	VQ7LO	6060
49.4+	W8XAL	6060
49.4+ Temporary	OXY	6600
49.8	DJC	6020
49.8+	COC	6010
49.9+ Irregular	RV59	6000
49.9+ Irregular	RV59	6000
50.4	HJ2ABA	5880
50.6 Irregular	HJ4ABE	5860
23 G. M. T. 6 P. M. E. S. T.		
15.9+ Except Sat., Sun.	PLE	18860
25.2	W8XK	11870
25.4+ Sun.	W1XAL	11790
25.5	DJD	11760
25.5	GSD	11750
25.6	FYA	11720
26.8 Tues., Thurs.	CT3AQ	11180
30.4	EAQ	9860
30.5+ Irregular	IRM	9820
31.2+ Tues., Fri.	CT1AA	9590
31.3	GSC	9585
31.3	HBL	9580
31.3+	W1XAZ	9570
31.3+	DJA	9560
31.4+	W2XAF	9530
38.4+ Sat.	HBP	7790
40.5	EA8AB	7403
45.0+ Sun.	HC2RL	6668
46.1	HJ5ABD	6504
45.5 Sun.	HJ1ABB	6450
46.6+ Fri.	W3XL	6425
47.8 Sun.	HI1A	6272
48.7+	YV3RC	6150
48.8+	W8XK	6140
49.0	W2XE	6120
49.0+	YV2RC	6112
49.0+	VE9HX	6110
49.1+ Sat.	W3XAL	6100
49.1+ Except Sat.	W9XF	6100
49.2 Except Fri., Sat.	VE9GW	6095
49.3+	W9XAA	6080
49.3+ Sun.	VE9CS	6070
49.3+ Temporary	YV5BMO	6070
49.4+	W8XAL	6060
49.4+ Temporary	OXY	6060
49.8	CQN	6020
49.8	DJC	6020
49.8+ Sun., Irregular	COC	6010
49.9+	XEBT	6006
50.6 Tues., Thurs., Sat.	HJ4ABE	5860
51.4+	HJ2ABC	5824
69.4 Irregular	G6RX	4320
00 G. M. T. 7 P. M. E. S. T.		
15.9+ Except Sat., Sun.	PLE	18860
25.2	W8XK	11870
25.4+ Sun.	W1XAL	11790
25.5	DJD	11760
25.5	GSD	11750
25.6	FYA	11720
28.9+	LSX	10350
30.4	EAQ	9860
30.5 + Irregular	IRM	9820

WAVE TIME TABLE

13.9+	GSH	21470
14.2+	LSN	21020
16.8+	GSG	17790
16.8+ Ex. Tues., Wed.	PHI	17775
19.6+	FYA	15243
19.7	DJB	15200
23.3+ Sun.	CNR	12830
24.8+ Sun.	CT1CT	12082
26.0	XGR	11530
31.2+ Sun.	VK2ME	9590
31.3 Except Sun	VK3LR	9579
31.3+	W1XAZ	9570
31.3+	DJA	9560
31.4+	LCL	9540
31.8	PLV	9415
38.0+	JVR	7880
48.9+ Except Sun.	ZTJ	6122
49.2 Fri., Sat	VE9GW	6095
49.4+	W8XAL	6060
49.8	CQN	6020
49.8+ Mon. Wed., Thu.	ZHI	6012
52.9+	XQAJ	5660
70.2 Except Sun.	RV15	4273

13 G. M. T. 8 A. M. E. S. T.

13.9+	W8XK	21540
13.9+	GSH	21470
14.2+	LSN	21020
16.8+	W3XAL	17780
16.8+	GSG	17790
16.8+ Ex. Tues., Wed.	PHI	17775
17.2	J1AA	17380
19.6+	CP5	15308
19.6+	FYA	15243
19.7	DJB	15200
19.8	GSF	15140
23.3+ Sun.	CNR	12830
24.8+ Sun.	CT1CT	12082
25.1+ Sun.	RNE	11924
26.0	XGR	11530
31.2+ Sun.	VK2ME	9590
31.3 Except Sun.	VK3LR	9579
31.3+	W1XAZ	9570
31.3+	DJA	9560
31.4+	LCL	9540
31.8	PLV	9415
48.9+ Sun.	ZTJ	6122
49.2 Fri., Sat.	VE9GW	6095
49.3+ Tues, Thurs.	OER2	6072
49.4+	W8XAL	6060
49.5 Sun.	OXY	6060
52.9+	XQAJ	5660
70.2	RV15	4273

14 G. M. T. 9 A. M. E. S. T.

13.9+	W8XK	21540
14.2+	LSN	21020
16.8+	GSG	17790
16.8+	W3XAL	17780
16.8+ Ex. Tues., Wed.	PHI	17775
19.6+	CP5	15308
19.6+	FYA	15243
19.7	DJB	15200
19.8	GSF	15140
26.0	XGR	11530
31.2+ Sun.	VK2ME	9590
31.3 Except Sun.	VK3LR	9579
31.3+	W1XAZ	9570
31.3+	DJA	9560
31.4+	LCL	9540
31.8 Except Sat., Sun.	PLV	9415
48.9+	ZTJ	6122
49.0+	YV2RC	6112
49.0+	VE9HX	6110
49.2 Fri., Sat.	VE9GW	6095
49.3+ Tues, Thurs.	OER2	6072
49.4+ Irregular	W8XAL	6060
70.2	RV15	4273
80.0 Sun.	CT1CT	3750

15 G. M. T. 10 A. M. E. S. T.

13.9+	W8XK	21540

17 G. M. T. 12 Noon E. S. T.

13.9+	W8XK	21540
14.2+	LSN	21020
16.8+	W3XAL	17780
17.3+ Fri.	W3XL	17300
19.6+	W2XE	15270
19.7	W8XK	15210
19.8	GSF	15140
25.2	FYA	11900
25.3	GSE	11865
25.4	I2RO	11810
25.5	DJD	11760
25.6 Irregular	FYA	11720
26.0 Irregular	XAM	11530
30.4+ Sat.	EAQ	9860
30.6+ Irregular	GCW	9790
31.2+	XETE	9600
31.2+	W3XAU	9590
31.2+ Sun.	VK2ME	9590
31.3+	W1XAZ	9570
31.4+	LCL	9540
40.5 Except Sun.	HJ3ABD	7402
45.3+	RV72	6611
46.5	HJ1ABB	6450
47.5 Sun.	HIZ	6315
47.8 Tues., Fri.	HI1A	6272
48.9+	ZTJ	6122
49.0+ Ex. Sat., Sun.	VE9HX	6110
49.2 Fri., Sat., Sun.	VE9GW	6095
49.3+ Irregular	W9XAA	6080
49.3+ Tues., Thurs.	OER2	6072
49.4+	VQ7LO	6060
49.4+	W8XAL	6060
49.8	DJC	6020
49.8+ Sat., Sun.	ZHI	6012

18 G. M. T. 1 P. M. E. S. T.

13.9+	W8XK	21540
14.2+	LSN	21020
16.5+	LSY	18115
16.8+	W3XAL	17780
17.3+ Fri.	W3XL	17300
19.7	W8XK	15210
25.2	FYA	11900
25.4	I2RO	11810
25.5	DJD	11760
25.5	GSD	11750
29.0+	ORK	10330
30.4 Sat.	EAQ	9860
30.6+ Irregular	GCW	9790
31.2+	XETE	9600
31.2+	W3XAU	9590
31.3+	W1XAZ	9570
31.4+	LCL	9540
31.5	GSB	9510
47.5 Sun.	HIZ	6315
47.8 Sun.	HI1A	6272
48.9+	ZTJ	6122
49.0+ Except Sat., Sun.	VE9HX	6110
49.2 Fri., Sat., Sun.	VE9GW	6095
49.3+ Irregular	W9XAA	6080
49.3+ Tues., Thurs.	OER2	6072
49.3+ Sun.	VE9CS	6070
49.4+	VQ7LO	6060
49.4+	W8XAL	6060
49.4+ Temporary	OXY	6060
49.8	DJC	6020
73.0+ Except Mon.	HCJB	4107

19 G. M. T. 2 P. M. E. S. T.

17.3+ Fri.	W3XL	17300
19.5 Ex. Tu., Th., Sat.	W2XAD	15330
19.7	W8XK	15210
25.2	FYA	11900
25.4	I2RO	11810
25.5	DJD	11760
25.5	GSD	11750
29.0+	ZFD	10335
29.0+	ORK	10330
30.5+ Irregular	IRM	9820
30.6 Irregular	GCW	9790
50.1	TGX	5984

21 G. M. T. 4 P. M. E. S. T.

15.9+	PLE	18860
17.3+ Fri.	W3XL	17300
19.7	W8XK	15210
24.8+ Except Sun.	CT1CT	12082
25.2	FYA	11900
25.2	W8XK	11870
25.3+	W2XE	11830
25.4	I2RO	11810
25.5	DJD	11760
25.5	GSD	11750
29.0+	ZFD	10335
30.5+ Irregular	IRM	9820
30.6+ Irregular	GCW	9790
31.2+	CT1AA	9590
31.2+	W3XAU	9590
31.4+	LCL	9540
31.5	GSB	9510
31.8+	PLV	9415
32.2+ Sun.	CNR	9294
43.8+ Irregular	HAS	6840
47.5	HIZ	6315
47.8 Sun.	HI1A	6272
48.8+	W8XK	6140
48.9+ Sat.	ZTJ	6122
49.0+ Sun.	YV2RC	6112
49.0+	VE9HX	6110
49.1 Except Sat.	W9XF	6100
49.2 Except Fri., Sat.	VE9GW	6095
49.3+ Irregular	W9XAA	6080
49.3+ Sun.	VE9CS	6070
49.4+	W8XAL	6060
49.4+ Temporary	OXY	6060
49.8	DJC	6020
49.8+	COC	6010
49.9+	HIX	6000
49.9 Ex. Tues., Thu. Sat.	RV59	6000

22 G. M. T. 5 P. M. E. S. T.

15.9+Irregular	PLE	18860
24.8+ Ex. Sun.	CT1CT	12082
25.2	FYA	11900
25.2	W8XK	11870
25.4	I2RO	11810
25.4+ Except Sat.	W1XAL	11790
25.5	DJD	11760
25.5	GSD	11750
26.8	CT3AQ	11180
30.4	EAQ	9860
30.5+ Irregular	IRM	9820
31.2+ Tues., Fri.	CT1AA	9590
31.2+	W3XAU	9590
31.3	HBL	9580
31.3+	W1XAZ	9570
31.3+	DJA	9560
31.5	GSB	9510
38.4+ Sat.	HBP	7790
43.8+ Irregular	HAS	6840
45.0+ Sun.	HC2RL	6668
46.1	HJ5ABD	6504
46.5 Sun.	HJ1ABB	6450
46.6+ Fri.	W3XL	6425
47.5	HIZ	6315
47.8 Sun.	HI1A	6272
48.7+	YV3RC	6150
48.8+	W8XK	6140
49.0	W2XE	6120
49.0+	YV2RC	6112
49.0+ Sat.	VE9HX	6110
49.1+ Sat.	W3XAL	6100
49.1+ Except Sat.	W9XF	6100
49.2 Except Fri., Sat.	VE9GW	6095
49.3+	W9XAA	6080
49.3+ Sun.	VE9CS	6070
49.3+ Temporary	YV5BMO	6070
49.4	W8XAL	6060
49.4+ Temporary	OXY	6060
49.8+	COC	6010
49.9+	HIX	6000
31.2+	XETE	9600
31.3	GSC	9585
31.3	HBL	9580
31.3+	W1XAZ	9570
31.4	W2XAF	9530
32.8+	CP5	9120
36.6+	PSK	8185
38.4+ Sat., Irregular	HBP	7790
40.5	HJ3ABD	7402
45.0+ Sun.	HC2RL	6668
46.1	HJ5ABD	6504
46.5	HJ1ABB	6450
46.6+ Fri.	W3XL	6425
47.8	HI1A	6272
48.5	TGW	6180
48.7+	YV3RC	6150
48.8+	W8XK	6140
48.9+	ZGE	6130
49.0	W2XE	6120
49.0+	YV2RC	6112
49.0+	VE9HX	6110
49.1+Sat.	W3XAL	6100
49.2+ Except Fri., Sat.	VE9GW	6095
49.3+	W9XAA	6080
49.3+	VE9CS	6070
49.3+Temporary	YV5BMO	6070
49.4+	W8XAL	6060
49.6	W4XB	6040
49.8+	CQN	6020
49.8	DJC	6020
49.8+ Sun.	COC	6010
49.9+	XEBT	6006
50.1	TGX	5984
50.4 Irregular	HJ2ABA	5880
50.6 Except Wed., Sun.	HJ4ABE	5860
51.4+	HJ2ABC	5824
69.4 Irregular	G6RX	4320

01 G. M. T. 8 P. M. E. S. T.

25.2	W8XK	11870
25.5	DJD	11760
25.6	FYA	11720
25.6	CJRX	11720
31.2+	XETE	9600
31.3+	W1XAZ	9570
31.4+	W2XAF	9530
32.8+	CP5	9120
36.6+ Irregular	PSK	8185
37.5	HC2JSB	8000
40.5+ Except Sun.	HJ3ABD	7402
46.1	HJ5ABD	6504
46.5	HJ1ABB	6450
46.6+ Fri.	W3XL	6425
47.8	HI1A	6272
48.5+	TGW	6180
48.7+	CJRO	6150
48.7+	YV3RC	6150
48.8+	W8XK	6140
48.9+	ZTJ	6122
49.0	W2XE	6120
49.0+	YV2RC	6112
49.0+	VE9HX	6110
49.1+ Sat.	W3XAL	6100
49.1+ Except Sat.	W9XF	6100
49.2+ Except Fri., Sat.	VE9GW	6095
49.3+	W9XAA	6080
49.3+ Sun.	VE9CS	6070
49.3+ Temporary	YV5BMO	6070
49.4+	W8XAL	6060
49.4+	W3XAU	6060
49.6	W4XB	6040
49.8	DJC	6020
49.8+	COC	6010
49.9+	HIX	6000
50.1 Irregular	YV4BSG	5984
50.1	TGX	5984
50.4 Irregular	HJ2ABA	5880

(Continued on next page)

50.6 Mon., Wed., Fri.	HJ4ABE	5860
51.4	HJ2ABC	5824
69.4 Irregular	G6RX	4320
73.0+ Except Mon.	HCJB	4107

02 G. M. T. 9 P. M. E. S. T.

25.2	W8XK	11870
25.5	DJD	11760
25.6	CJRX	11720
28.1	CEC	10670
31.2+	XETE	9600
31.3+	W1XAZ	9570
31.4+	W2XAF	9530
32.8+	CP5	9120
36.6+ Irregular	PSK	8185
40.5+ Except Sun.	HJ3ABD	7402
45.0+ Tues.	HC2RL	6668
45.3 Thurs.	PRADO	6618
46.1	HJ5ABD	6504
46.5	HJ1ABB	6450
46.6+ Fri.	W3XL	6425
47.5 Sat.	HIZ	6315
47.8	HI1A	6272
48.5+	TGW	6180
48.7+	CJRO	6150
48.7+	YV3RC	6150
48.8+	W8XK	6140
48.9+	ZTJ	6122
49.0	W2XE	6120
49.0+	YV2RC	6112
49.0+	VE9HX	6110
49.1+ Sat.	W3XAL	6100
49.1+ Except Sat.	W9XF	6100
49.2 Except Sun.	VE9GW	6095
49.3+	W9XAA	6080
49.3+ Sun.	VE9CS	6070
49.3+ Temporary	YV5BMO	6070
49.4+	W8XAL	6060
49.4+	W3XAU	6060
49.6	W4XB	6040
49.8	DJC	6020
49.8+ Sun.	COC	6010
49.9+	HIX	6000
50.1 Irregular	YV4BSG	5984
50.1	TGX	5984
50.4 Irregular	HJ2ABA	5880
50.6 Mon., Wed., Fri.	HJ4ABE	5860
51.4	HJ2ABC	5824
69.4+	G6RX	4320
73.0+ Except Mon.	HCJB	4107

03 G. M. T. 10 P. M. E. S. T.

25.1+	RNE	11924
25.2	W8XK	11870
25.5 Irregular	DJD	11760
25.6	FYA	11720
25.6	CJRX	11720
31.2+	XETE	9600
31.3+	W1XAZ	9570
31.4+	W2XAF	9530
32.8+ Irregular	CP5	9120
40.5+ Except Sun.	HJ3ABD	7402
44.8	YNLF	6692
45.0+ Tues.	HC2RL	6668
45.3 Thurs.	PRADO	6618
46.5	HJ1ABB	6450
46.6+ Fri.	W3XL	6425
47.5 Sat.	HIZ	6315
47.8	HI1A	6272
48.5	TGW	6180
48.7+	CJRO	6150
48.7+	YV3RC	6150
48.8+	W8XK	6140
48.9+	ZTJ	6122
49.0	W2XE	6120
49.0+	YV2RC	6112
49.0+	VE9HX	6110
49.1+ Sat.	W3XAL	6100
49.1+ Except Sat.	W9XF	6100
49.2 Except Sun.	VE9GW	6095
49.3+	W9XAA	6080
49.3+ Sun.	VE9CS	6070
49.3+	YV5BMO	6070
49.4+	W8XAL	6060
49.4+	W3XAU	6060
49.8 Irregular	DJC	6020
49.9+ Sat.	HIX	6000
50.1 Irregular	YV4BSG	5984
50.1	TGX	5984
50.6 Mon., Wed., Fri.	HJ4ABE	5860
69.4+ Irregular	G6RX	4320
73.0+ Except Mon.	HCJB	4107

04 G. M. T. 11 P. M. E. S. T.

25.1+ Irregular	RNE	11924
25.2 Sun.	W8XK	11870
25.5	DJD	11760
25.5	GSD	11750
25.6	FYA	11720
25.6	CJRX	11720
31.2+	XETE	9600
31.3+	W1XAZ	9570
31.5	GSB	9510
45.0 Fri.	TGW	6180
45.0+ Tues.	HC2RL	6668
46.6+ Fri.	W3XL	6425
47.5	HIZ	6315
47.8	HI1A	6272
48.7+	CJRO	6150
48.7+Sat.	VE9CL	6150
48.8+	W8XK	6140
48.9+	ZTJ	6122
49.0	W2XE	6120
49.0+	VE9HX	6110
49.1+ Sat.	W3XAL	6100
49.1+ Except Sat.	W9XF	6100
49.2 Thurs., Fri., Sat.	VE9GW	6095
49.3+ Tues., Sun.	VE9CS	6070
49.4+	W8XAL	6060
49.4+	W3XAU	6060
49.8	DJC	6020
49.9+ Sat.	VE9DN	6005
49.9+ Sat.	HIX	6000
50.1	TGX	5984
73.0+ Except Mon.	HCJB	4107

05 G. M. T. 12 Midnight E. S. T.

19.7	DJB	15200
25.2 Sun.	W8XK	11870
25.5	GSD	11750
31.2+	XETE	9600
31.3+	W1XAZ	9570
31.5	GSB	9510
47.8	HI1A	6272
48.8+	W8XK	6140
48.9+	ZTJ	6122
49.0+	VE9HX	6110
49.1+ Except Sat.	W9XF	6100
49.3 Tues., Sun.	VE9CS	6070
49.4+	W3XAU	6060
49.4+	W8XAL	6060
49.8	DJC	6020
49.8+Sat.	COC	6010

06 G. M. T. 1 A. M. E. S. T.

25.5	GSD	11750
49.4+	W8XAL	6060
49.5+	GSA	6050

Station Locations

Wavelength Meters	Call Letters	Frequency Kc.	City Country
13.9+	W8XK	21540	Pittsburgh, Pa.
13.9+	GSH	21470	Daventry, England
14.2+	LSN	21020	Buenos Aires, Argen.
15.2+	IRW	19700	Rome, Italy
15.9+	PLE	18860	Bandoeng, Java
16.5	LSY	18115	Buenos Aires, Argen.
16.8+	GSG	17790	Daventry, England
16.8+	W3XAL	17780	Bound Brook, N. J.
16.8+	PHI	17775	Huizen, Holland
17.2+	J1AA?	17380	Kemikawa-Cho., Jap.
17.3+	W3XL	17300	Bound Brook, N. J.
19.5	W2XAD	15330	Schenectady, N. Y.
19.6+	CP5	15308	La Paz, Bolivia
19.6	FYA	15243	Pontoise, France
19.6+	W2XE	15270	New York, N. Y.
19.7	W8XK	15210	Pittsburgh, Pa.
19.7	DJB	15200	Zeesen, Germany
19.8	GSF	15140	Daventry, England
19.8	HVJ	15123	Vatican City
23.3	CNR	12830	Rabat, Morocco
24.8+	CT1CT	12082	Lisbon, Portugal
25.1+	RNE	11924	Moscow, U. S. S. R.
25.2	FYA	11900	Pontoise, France
25.2	W8XK	11870	Pittsburgh, Pa.
25.3	GSE	11865	Daventry, England
25.3+	W2XE	11830	New York, N. Y.
25.4	I2RO	11810	Rome, Italy
25.4+	W1XAL	11790	Boston, Mass.
25.5	DJD	11760	Zeesen, Germany
25.5	GSD	11750	Daventry, England
25.6	FYA	11720	Pontoise, France
25.6	CJRX	11720	Winnipeg, Canada
26.0	XGR	11530	Shanghai, China
26.8	CT3AQ	11180	Funchal, Madeira
28.1	CEC	10670	Santiago, Chile
28.9+	LSX	10350	Buenos Aires, Argen.
29.0+	ZFD	10335	Hamilton, Bermuda
29.0+	ORK	10330	Brussels, Belgium
30.0	KAZ	9994	Manila, P. I.
30.4	EAQ	9860	Madrid, Spain
30.4+	JYS	9840	Kemikaway Cho, Jap.
30.5+	IRM	9820	Rome, Italy
30.6+	GCW	9790	Rugby, England
31.2+	XETE	9600	Mexico City, Mexico
31.2+	CT1AA	9590	Lisbon, Portugal
31.2+	W3XAU	9590	Philadelphia, Pa.
31.2+	VK2ME	9590	Sydney, Australia
31.3	HBL	9580	Geneva, Switzerland
31.3	VK3LR	9579	Melbourne, Australia
31.3	GSC	9575	Daventry, England
31.3+	W1XAZ	9570	Springfield, Mass.
31.3+	DJA	9560	Zeesen, Germany
31.4+	W2XAF	9530	Schenectady, N. Y.
31.5	VK3ME	9510	Melbourne, Australia
31.5	GSB	9510	Daventry, England
31.4+	LCL	9540	Jeloy, Norway
31.8	PLV	9415	Bandoeng, Java
32.2+	CNR	9294	Rabat, Morocco
32.8+	CP5	9120	La Paz, Bolivia
36.2+	CM6XJ	8265	Tuinucu, Cuba
36.6+	PSK	8185	Rio de Janeiro, Braz.
37.5	HC2JSB	8000	Guayaquil, Ecuador
38.0+	JVR	7880	Kemikawa-cho Japan
38.4+	HBP	7790	Geneva, Switzerland
40.5+	HJ3ABD	7402	Bogota, Colombia
43.8+	HAS	6840	Budapest, Hungary
44.8	YNLF	6692	Managua, Nicaragua
45.0+	HC2RL	6668	Guayaquil, Ecuador
45.3	PRADO	6618	Riobamba, Ecuador
45.3+	RV72	6611	Moscow, U. S. S. R.
46.1	HJ5ABD	6504	Cali, Colombia
46.5	HJ1ABB	6450	Barranquilla, Col.
46.6	W3XL	6425	Bound Brook, N. J.
47.5	HIZ	6315	San Domingo, D. R.
47.8	HI1A	6272	San Domingo, D. R.
48.5	TGW	6180	Guatemala City
48.7+	CJRO	6150	Winnepeg, Manitoba
48.7	YV3RC	6150	Caracas, Venezuela
48.7	VE9CL	6150	Winnipeg, Man.
48.8+	W8XK	6140	Pittsburgh, Pa.
48.9+	ZGE	6130	Kuala Lumpur, F. M. S.
48.9+	ZTJ	6122	Johannesburg, Africa
49.9	W2XE	6120	New York, N. Y.
49.0+	YV2RC	6112	Caracas, Ven.
49.0+	VE9HX	6110	Halifax, N. S.
49.1+	W3XAL	6100	Bound Brook, N. J.
49.1+	W9XF	6100	Chicago, Ill.
49.2	VE9GW	6095	Bowmanville, Can.
49.3+	OER2	6072	Vienna, Austria
49.3+	W9XAA	6008	Chicago, Ill.
49.3+	VE9CS	6070	Vancouver, B. C.
49.3+	YV5BMO	6070	Maracaibo, Venez.
49.4+	W8XAL	6060	Cincinnati, Ohio
49.4+	W3XAU	6060	Philadelphia, Pa.
49.4+	OXY	6060	Skamlebaek, Den.
49.5+	GSA	6050	Daventry, England
49.6+	W4XB	6040	Miami, Fla.
49.8	DJC	6020	Zeesen, Germany
49.8	CQN	6020	Macao, China
49.8+	ZHI	6012	Singapore, Malaya.
49.8+	COC	6010	Havana, Cuba
49.9+	XEBT	6006	Mexico City, Mex.
49.9+	VE9DN	6005	Montreal, Quebec
49.9+	HIX	6000	San Domingo, D. R.
49.9+	RV59	6000	Moscow, U. S. S. R.
50.1	YV4BSG	5984	Caracas, Venezuela
50.1	TGX	5984	El Liberal, Guatemala
50.2+	HVJ	5969	Vatican City
50.4	HJ2ABA	5880	Tunja, Colombia
50.6+	HJ4ABE	5860	Medellin, Colombia
51.4+	HJ2ABC	5824	Cu Cuta, Colombia
52.7	XQAJ	5660	Shanghai, China
69.4	G6RX	4320	Rugby, England
70.2	RV15	4273	Khabarovsk, Siberia
73.0	HCJB	4107	Quito, Ecuador
80.0	CT1CT	3750	Lisbon, Portugal

FAMOUS DUTCH RADIO ANNOUNCER

This is Edward Startz, radio announcer and studio manager of station PHI, the transmitter of which is shown in the heading this month. He speaks seven languages fluently.

The DX Corner

(*Continued from page* 87)

East Africa, reported as heard 1:30 to 3:30 p.m.

KNRA reported regularly on frequency No. 5 at 9 p.m., E.S.T., Thursdays and Sundays on frequency No. 9 at 9 a.m., C.S.T., testing with New York.

GFWV, S.S. Majestic, reported on 13220 kc.

K6XO reported on 11700 kc.

HV5ABC, Kali, Colombia, reported on 58 meters.

VE3KW, Simcoe, Ontario, reported on 122 meters.

CSN reported on 5805 kc. Is this the same as GFU?

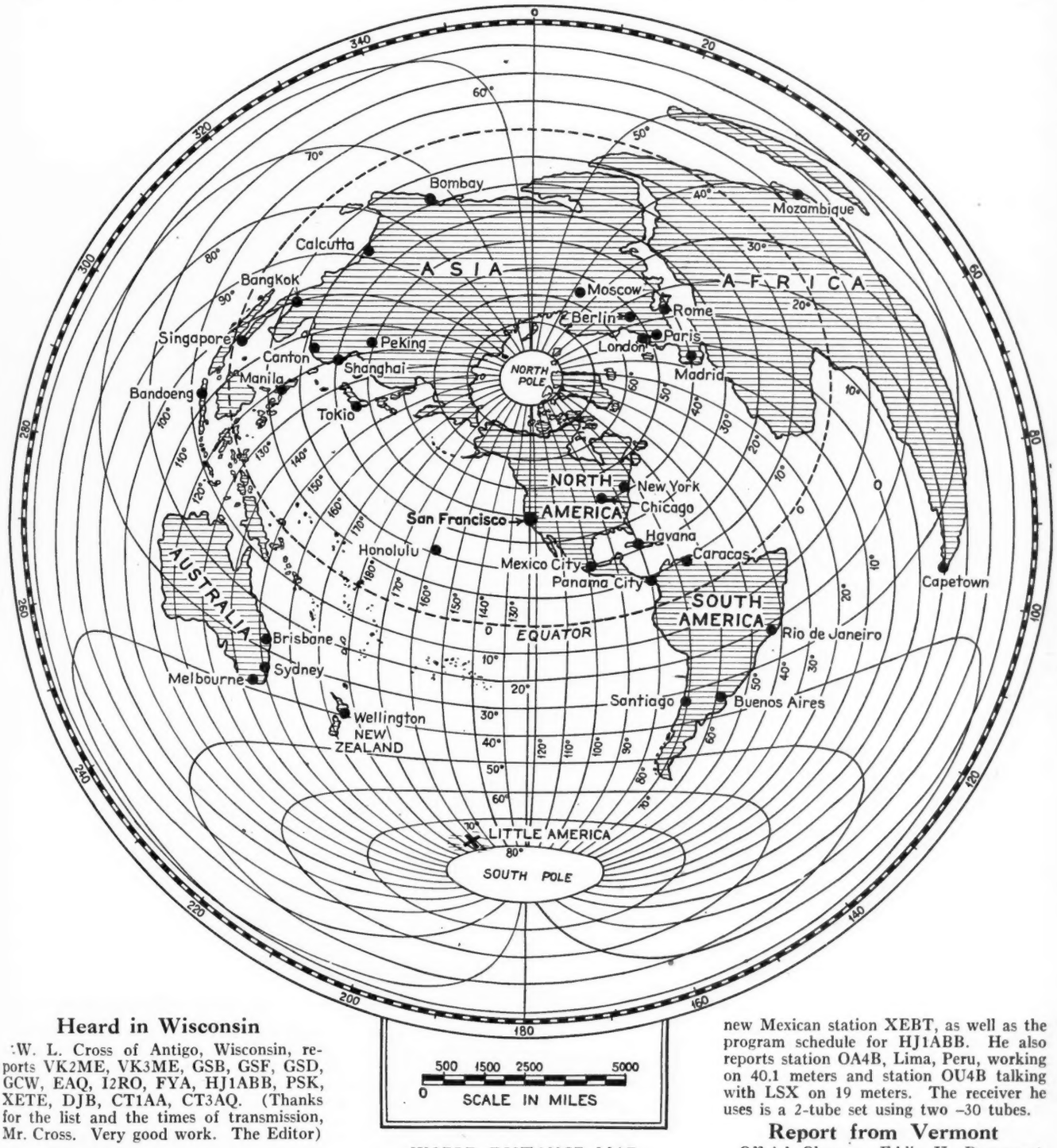
YV1BC and YV3BC calls are changed. YV1BC is now YV2RC. YV3BC is now YV3RC.

JVT reported near 40 meter "ham" band, plays a Japanese record over and over again, signs off at 5 a.m., calling KWW testing. Talks English with Japanese accent.

A Report from Maryland

A reader of RADIO NEWS resides 60 miles north, 23 miles west of Washington, D. C., 1500 feet above sea level, sends in a fine list of short-wave stations he hears on a Philco model 16-B receiver but neglects to sign his name. Some of the Best Bets we have picked out of this list are ZFE, LSY, all the Empire stations, all the Zeesen stations, LSN, HJ1ABB, CJRX, PHI, YV5BMO, EAQ, KNRA, CEC, ZFD. He states: "I always hear KNRH on 8820 kc. Have heard them the last five weeks on Saturday nights between 7:30 and 11:00 p.m. and the last week most any night other than Saturday talking to WEL, New York."

WORLD DISTANCE CHART No. 2



WORLD DISTANCE MAP FOR AMERICAN WEST COAST

Here is the azimuthal map centered on San Francisco for reckoning distances from there to any other location in the world. To use the map find the distance between San Francisco and the desired location and refer this to the scale in miles printed above to find the actual distance. This is the world distance chart No. 2. Distance chart No. 1, published in the July issue, showed a map centered on the East American Coast at New York

Heard in Wisconsin

W. L. Cross of Antigo, Wisconsin, reports VK2ME, VK3ME, GSB, GSF, GSD, GCW, EAQ, I2RO, FYA, HJ1ABB, PSK, XETE, DJB, CT1AA, CT3AQ. (Thanks for the list and the times of transmission, Mr. Cross. Very good work. The Editor)

An Official Report from Texas

Mr. Heinie Johnson, RADIO NEWS Observer for Texas, sends in a fine report, information from which is incorporated in our Time Schedule and says: "We are still able to hear China on 50 meters, in the early morning hours, as also can be said of the 38-meter Japanese station. Those wishing to hear these stations will appreciate this tip. Listen for Japanese signals around 3 a.m., C.S.T., as that is the strongest signal hour for them. If you do not hear them try again next morning as they are on at 2:30, C.S.T. one morning and not until 4 a.m., C.S.T., the next morning. The Chinese signal is not regular, but the best time is 6:30 a.m., C.S.T. and when you *do* hear them they will be very strong and do not weaken until after 7:30. (Thanks, Heinie. The Editor)

A Report from Mexico

Mr. Felipe L. Saldana of Huamantla, Tlax, Mexico, reports station I3RO as experimenting near 30 meters, just over EAQ. He gives the schedules of TGX and the new Mexican station XEBT, as well as the program schedule for HJ1ABB. He also reports station OA4B, Lima, Peru, working on 40.1 meters and station OU4B talking with LSX on 19 meters. The receiver he uses is a 2-tube set using two –30 tubes.

Report from Vermont

Official Observer Eddie H. Davenport, Pittsford, Vermont, reports the following Best Bets: CP5, (on 19.6 meters); LSY, (16.55 meters); PHI, DJB, GSF, FYA, DJD, GSE, VK2ME, HBL, DJA, EAQ, GSC, YV3RC, VE9GW, YV2RC, GSA, DJC, VE9DM, W8XAL, W8XK, COC. He reports the 49-meter band strong but full of QRN. Signals are stronger below 35 meters.

Official Report from Tennessee

Official Observer Moss of Dyersburg, Tennessee, reports the 49-meter band quite noisy, the 31-meter band very dependable, very little noise. He was the first to report VK3LR, owned and operated by the Research Laboratories of the Postmaster General's Department, 59 Lt. Collins Street, Melbourne, Australia. The 25-

(*Continued on page* 118)

SHORT-WAVE PAGE

THE Editors welcome Captain Horace L. Hall, noted authority on short-wave reception, in an exclusive series for RADIO NEWS short-wave readers.

SHORT-WAVE listeners have the habit of bemoaning the fact that they have so little time to scan the ether waves for new catches. But how few fans are not lucky enough to be able to count on listening either to their favorite stations or even touring the world on Saturday and Sunday? Let us start on a voyage together, via the short waves. For those who have half a day on Saturday, we will start (on that day) at noon to see how many "foreign ports" we can enter. All we need for our cruise is a good short-wave receiver capable of being "steered" thousands of miles, an easy chair, an excellent S.W. Station Time Table and a pencil and paper to take notes on, programs, etc. But before we ever contemplate this trip we should see to it that we have a good aerial. Is it soldered? Is it long enough? Have we experimented with it and know just how good it is? An article in this issue can help you there.

Now we are all set. Off we go! On Saturday we have the special transmissions from EAQ (30.4 meters), Madrid, Spain, from 1 to 3 p.m., E.S.T. We will hear the "Ah-Chee-Ah-Coo" roll in and listen to this for a short while, as we can go back to this land of raven-haired señoritas later in the day. With one twist of the dials we have leaped 3731 miles.

On to Rome, I2RO (25.4 meters), who will undoubtedly be radiating a truly beautiful operatic program will be logged with slight effort. We linger here for a while, close our eyes, hear the masses applaud the singers. Then silence. Long wait of maybe three minutes. Then in a sweet, perfectly modulated female voice comes the station announcement, 'Radio Roma-Napoli." To be in Rome, city built on hills, city of ruins and catacombs! If we were traveling by rail instead of air, we would be attracted by the flowers, Italian plants and the historic fountains.

We leave Rome to hear a typical jazz orchestra conducted by Henry Hall of the BBC Orchestra. England we have reached with one jerk at the dial. Daventry (on either 25.99 meters or 31.55 meters) will pound in, and after the music comes, maybe, the news or a flash of British humor? Good old England, land that will not verify, land of tram cars, tea tottlers, pea-soup fog, boats, ships, commerce, Kings, parades and the finest programs over the "world renown" station: Daventry. Listening to British programs, similar in outline to our own American style, may not excite but will thrill us, so we "clear" this port and on to the next.

Across the English Channel to France. On the outskirts of Paris we will hear Pontoise (on either 25.2 meters or 25.63 meters). A haughty Frenchman will be "parley-vouzing" in his own inimitable fashion. Talking about debts, they see no reason to pay; sending greetings to colonists in Africa who probably have no short-wave receivers; giving the latest stock quotations, and so on far into the night. Paris on the ether waves is not like Paris when I saw it last. Then our American dollar was worth plenty. American doughboys were treated like millionaires and chic Parisian mannequins flirted viciously. Oh! Oh!

Paris, Rome, Spain, England left behind us, we stop for a few minutes to listen to the League of Nations, harbored at Geneva, Switzerland. Roaring in on two frequencies (31.27 meters [HBL] and 38.47 meters [HBP]), we hear the worldly troubles aired in three languages, French, English and Spanish. We listen half-heartedly and find that we *might* be interested if we were diplomats, but as we are only short-wave fans, we turn to Germany for band music or folk songs as only the Germans can sing them. Coming over (on 25.51 meter [DJD] or 31.38 meters [DJA]) to our horror, we hear a political speech. *"Donner und Blitzen!"* We listen, impressed only by the fact that so much energy is being spent for so little results. Stop. Silence. "Hello, North America. Here is the Deutschlandsender. We will now present an opera relayed from Leipzig." Beautiful, serene and high-quality music makes our speaker vibrate. We think when we were there last. Oh, yes. Hamburg. Ships. Beautiful blonde Russian women. Refugees. Hunger. A dollars' worth of marks—where to put them? More ships.

Sail off to Spain again, who will be waiting for us with Castilian songs and throaty-voiced men and tired-sounding women. Here it is 6 p.m., but in Madrid it is close to midnight. We listen. Pretty music, but having traveled 24,384 miles on our tour, we are too tired to wax enthusiastic about the stirring tangoes. Spain—olive oil, flowers, cactus, shawls and the beautiful blue Mediterranean.

Home again. Just in time for supper. We switch off our receiver. Eat and ponder on our voyage, then plot our course for South America. Here we will listen to untuned pianos, stations that defy identification, soprano-voiced "señors" and "señoritas", gongs, bells, automobile horns and last, but by far the least, advertisements for hats, cigarettes, radios, clocks—everything, in fact.

We dock at Venezuela. There we have our choice of YV1BC (49 meters), YV3BC (48.78 meters), also in Caracas, and YV5BMO (49.39 meters), Maracaibo. The latter will be on until 10 p.m. The other two until 9:30 or 10 p.m., E.S.T. We wander from one to the other and then skip over to "La Voz de Barranquilla," HJ1ABB (on 46.47 meters), who with their new transmitter are heard with unexcelled volume. Cali, Colombia (on 46.3 meters), may be on but one cannot count on these Spaniards. Temperament "gets the best" of schedules with these highly excitable South Americans.

From southern climate we journey to Canada. We cannot fail to hear the deep-voiced announcer of VE9GW, Bowmanville, Canada, (48.22 meters). He always sounds as though he were talking in one of the laaa-rgest studios ever built and the voice is so extremely *bass* we wonder just what he looks like in person.

We have gone to nine countries and covered three continents. Tomorrow we will hear the last remaining three at least two, Australia and Africa we can be sure off.

So to bed. Early to rise. At about seven o'clock (a.m.) Sunday we are back with our receiver, confident of new goals to reach. First to Australia. VK2ME, (31.29 meters) Sydney, Australia, breaks the morning's quiet with recorded music. Station announcements come fast and furious. By 7:30 a.m. the signal strength has so increased we hardly can believe we are listening to a program coming 10,018 miles. Sydney; Kook-a-burra birds, kangaroos, sheep and ardent listeners to Daventry's programs.

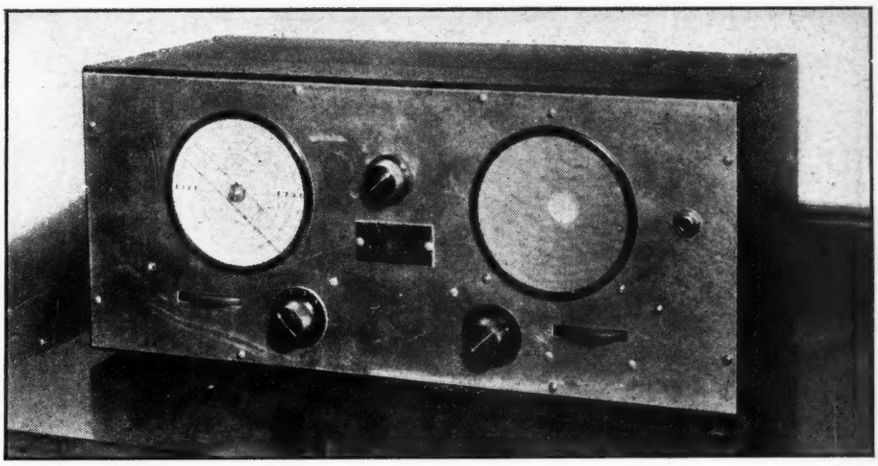
We slip out of port and steer for Morocco. Rabat (on 23.38 meters) conveniently (*Continued on page* 124)

A Compact

S. W. RECEIVER

(The Skyrider)

The Technical Editor



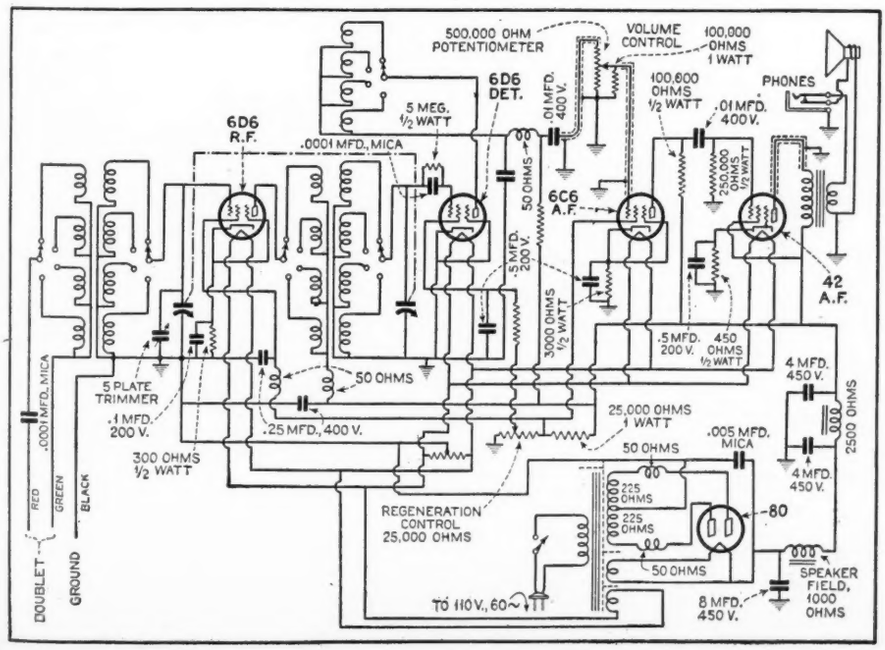
WE feel that there is a definite need for a complete, very compact short-wave receiver, to bring in the whole short-wave band from 200 meters down. The Skyrider receiver described in this short article, is such a set equipped with a major tuning dial, calibrated in wavelength and frequency, controlled by a "thumb" knob, placed horizontally in the panel. This kind of a thumb control is also used for the regenerative control at the right of the panel. Located diagonally above this is the loudspeaker grill. An upper central control knob is a trimmer and two lower central control knobs are a wave-switch (on the left) and a gain control (on the right). The tuning of this little receiver is just about as simple and easy as the description of the front panel just made.

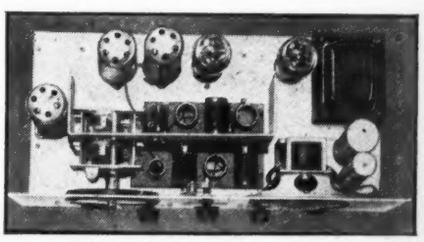
The circuit employed is one that has always been famous among the amateurs but it has been rearranged and considerably simplified by using newest-type tubes (which are furnished with the receiver) matched in the laboratory. Starting at the aerial, the set uses a doublet antenna with a transposed lead-in and a separate ground. The doublet feeds into the *red* and *green* wires with the ground attached to the *black* wire coming from the receiver. The three sets of coils are arranged in connection with a wave-change switch, to tune the input to the first tube which is a radio-frequency amplifier, the input and the output to the second tube and also the regenerative plate circuit of the second tube which is the detector. These two tubes are the new 6D6 types. The regeneration control is a 25,000-ohm variable resistance. The output of the detector tube feeds into a 6C6 audio amplifier tube with the volume control in the grid circuit, as shown in the diagram. The output circuit of this stage feeds into a 42 tube, feeding the loudspeaker through a transformer. A 'phone jack is provided for listening-in for distance stations if desired. The whole receiver is fed by a self-contained power pack using an 80 full-wave rectifier tube. A careful perusal of the circuit diagram should clear all the circuit details, giving constants wherever possible.

In testing out the receiver in the RADIO NEWS Short-wave Listening Posts, it was used to bring in the usual run of short-wave DX signals, including the following: GSB, GSC, GSF, DJB, DJA, DJC, VE9GW, CJRX, XETE, XEBT, I2RO, HBL, YV3BC, YV2RC, HJ1ABB, HC2RL, W8XAL, W8XK, W1XAL, W1XAZ, PSK, EAQ, W2XE. During these tests it took only a comparatively short time to become accustomed to using the regenerative sensitivity control without annoyance. A careful operation of this control increased the selectivity tremendously, as well as setting up a louder signal. Where a high degree of selectivity is required, the regeneration control is set critically and the volume reduced by means of the gain control. The trimmer control was also found very useful in tuning in some of those hard-to-get stations.

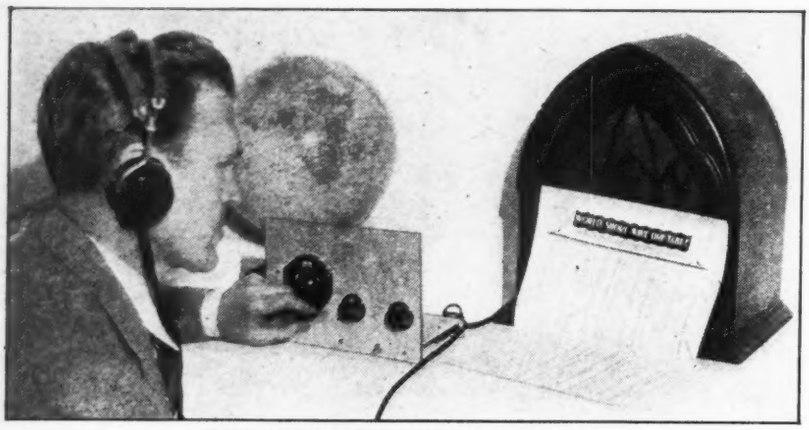
Beside the DX short-wave broadcasts, the set tunes in the following frequencies, in four steps: First from 200 to 97 meters—this frequency band covers aircraft, commercial 'phones, ship stations, amateur telephones, police calls; second, 100 to 48 meters—this band covers foreign and domestic broadcasts, airport transmitters, beacons, commercial 'phones and amateurs; third, 50 to 27 meters—short-wave broadcast stations, amateurs, commercial 'phones and a few aircraft stations; and fourth, 29 to 12 meters—this band covers the low-wavelength DX broadcast stations, a raft of international 'phones, the 20-meter amateur band and just takes in some of the frequencies of the Byrd expedition, including Buenos Aires.

As can be seen from the photographs, the set is simple, neat and business-like in design and lacking most of the ordinary ornamental "trim" of some receivers. The receiver is enclosed in a crackle finish metal shielded cabinet with a front panel of Eurado, a brightly lacquered metal. The loudspeaker bezel is the same diameter as the tuning dial. The size of the set, overall, is 17 inches by 7½ inches by 7½ inches. Its total weight, packed ready-to-ship including tubes and coils, is 24 pounds. It makes an excellent job for listening to amateur telegraphy as well as to broadcasting.





RADIO NEWS LABORATORY RECEIVERS—No. I



THE "DRAGNET" DRAGS 'EM IN

Testing this receiver in New York City, short-wave stations of Germany, France, England, Italy and South America were heard clearly; some at low loud speaker volume

The DRAGNET

(2 Tube S. W. Set)

A simple receiver, designed in our own laboratory for the home constructor who is after real results at low initial cost

S. Gordon Taylor

BEFORE going into the discussion of the short-wave receiver described in this article, a brief consideration of simple receiver design seems appropriate.

There can be no question that the 1-tube regenerative receiver offers the most simple and inexpensive type of practical short-wave set. Thousands upon thousands of them have been constructed over a period of several years and many thousands are in use today.

In spite of this deserved popularity, however, these little receivers have certain drawbacks. The first of these is the irregular control of regeneration resulting from absorption of energy by the antenna which makes it difficult to bring the tube up to the point of maximum sensitivity at certain parts on the dial. Next is the fact that the best of these 1-tubers radiate interference when operated in an oscillating condition—or on the edge of oscillation, as they frequently are when tuned to a very weak station. Steps have been taken in many of these receivers to overcome or at least reduce trouble from antenna absorption. The methods include various means for reducing the degree of coupling betwen the antenna and tube circuits. If coupling is made sufficiently loose, the amount of energy drawn from the tube circuit is not sufficient to prevent regeneration. However, such loose coupling results in decreased signal strength. If the coupling is made variable so that it may be made extremely loose at frequencies at which the antenna tends to resonate (and at which it absorbs most energy) and tighter at other parts of the range, results are much better. Tuning is greatly complicated by this latter procedure, however, because it means that for maximum results the coupling control has to be constantly readjusted while tuning; and furthermore, this control reacts on the wavelength tuning control and the regeneration control to further add to the complexities of tuning such a receiver.

It was with these drawbacks in mind that the RADIO NEWS technical staff undertook to develop a little receiver, the purpose being to provide a design which would be simple to construct and operate, inexpensive, highly sensitive and with enough output to comfortably operate headphones even on extremely weak signals. The result of this undertaking is the RADIO NEWS "Dragnet" receiver as described in this article.

Reference to the diagrams of Figure 1 will show what might be termed the fundamental evolution of this new receiver. (A) shows the circuit of a typical 1-tube regenerative receiver with the antenna coupled to the tube circuit by means of a variable condenser. This is the circuit which has the inherent drawbacks mentioned above. In this and the other two circuits of this Figure some details such as by-pass condensers, filament supply, etc., have been omitted for the sake of simplicity.

(B) shows this same circuit but with another tube, VT1, ahead of the former single tube. This is the method used in the "Dragnet" receiver to overcome the objectionable features of Figure 1 (A). The tube, VT1, serves as an r.f. amplifier and also as a blocking tube. In its latter capacity it effectively isolates the antenna from the detector tube circuit and thus prevents both antenna absorption and radiation. Thus "in one fell swoop," as the poet says, the outstanding drawbacks of the 1-tube receiver are eliminated. Nor is this all. This added tube actually provides a substantial amount of amplification and therefore greater sensitivity.

The tuned circuit is still in the grid of the detector, but likewise is directly in the plate circuit of the r.f. tube. This is important because with modern r.f. tubes, if they are to provide high gain,

Outstanding Features

(1) Three-tube performance with two tubes.

(2) Strictly a non-"blooper".

(3) Eliminates the usual irregular and critical control of regeneration.

(4) Brings in world-wide, short-wave programs.

(5) Provides comfortable headphone volume even on far distant stations.

(6) A given station will always come in at the same dial setting.

(7) Costs slightly over $8.00 for parts, exclusive of coils, tubes and batteries.

Blueprints — For constructors who prefer to work from blueprints, a set has been prepared, including Figures 3, 4 and 5 (life size) also Figure 2 and Table 1. This complete set of prints is available to readers at a nominal price of 25c to cover cost of preparing, handling and mailing.

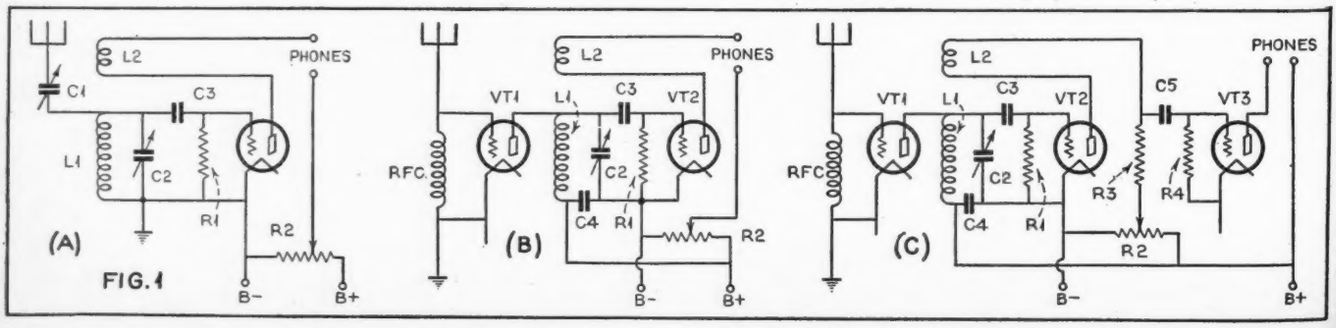


FIG. 1

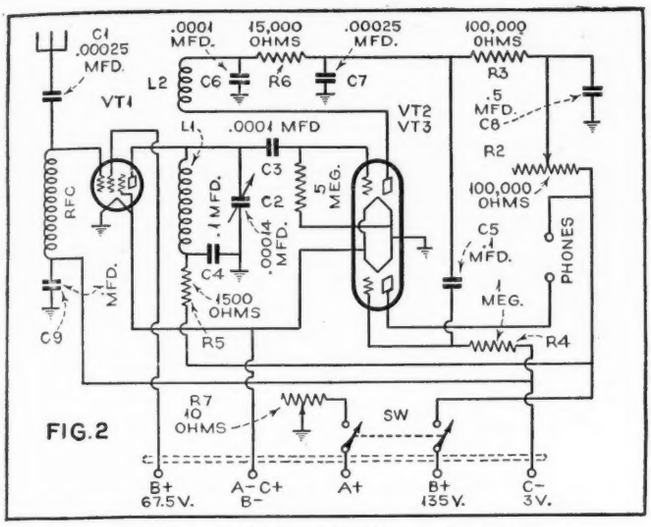
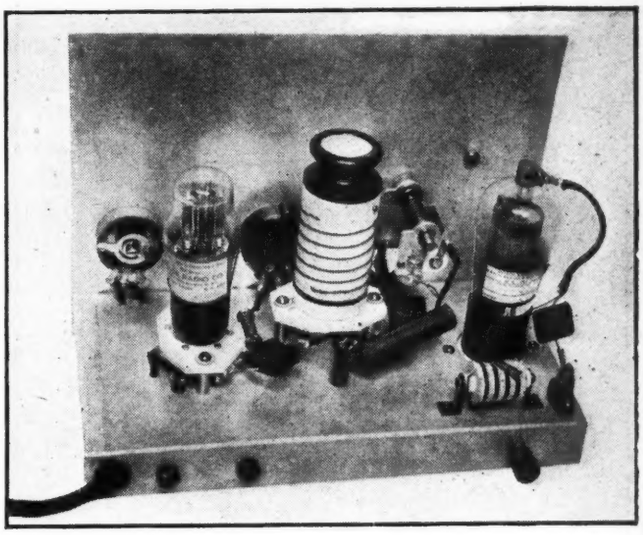


FIG. 2

THE "DRAGNET" CIRCUIT DIAGRAM

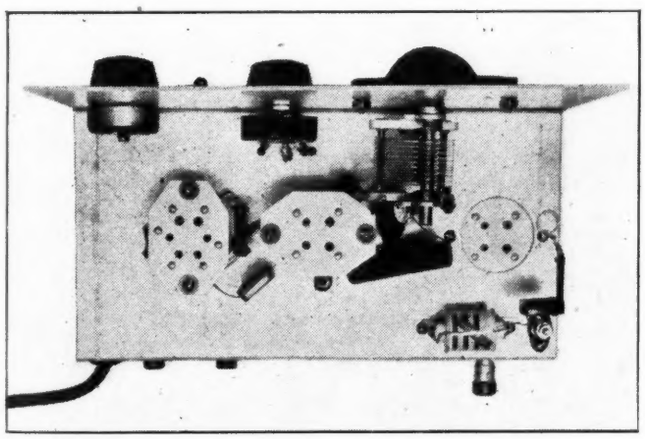


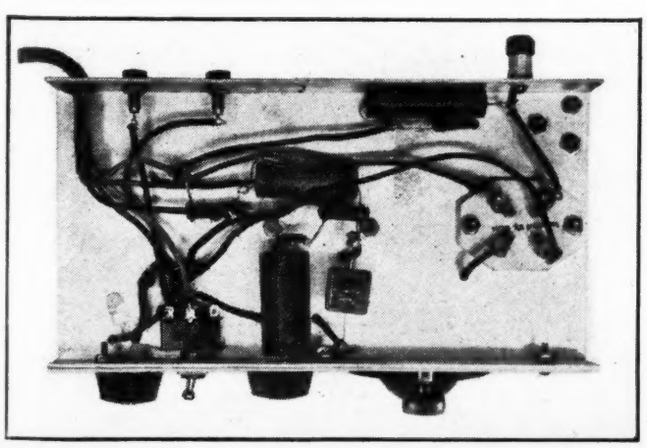
it is necessary that the load impedance be extremely high—a condition very satisfactorily met by an efficient tuned circuit. The input to the r.f. tube is untuned. If it were tuned there would be still further improvement in the results obtained, both in sensitivity and selectivity. However, a tuned circuit here would require a second set of plug-in coils, another tuning condenser and a certain amount of shielding, all of which would add considerably to the cost of this circuit and have therefore been omitted for the sake of simplicity and economy.

Many owners of 1-tube receivers regret the lack of good headphone volume when receiving distant stations. Veterans in the game have found it advisable to add a stage of audio amplification to build up the headphone strength and the circuit of Figure 1 (C) shows an economical method of accomplishing this, employing a resistance coupled tube, VT3, after the detector. This circuit, which is otherwise the same as circuit (B) would therefore seem to represent about the ideal set-up for anyone who wants really superior short-wave reception, without going to great expense or getting into the complications of multiple tuned circuits, shielding, etc. This is therefore the fundamental circuit adopted for the "Dragnet".

The detailed circuit is shown in Figure 2. Here it will be seen that the main variation from the circuit of Figure 1 (C) lies in the use of a dual-purpose tube, the type 19, to combine in one tube the functions of regenerative detector and audio amplifier. This tube is a double triode with the two groups of elements independent except for a filament which is common to both. Thus in this receiver 3-tube performance is obtained although only 2 tubes are employed.

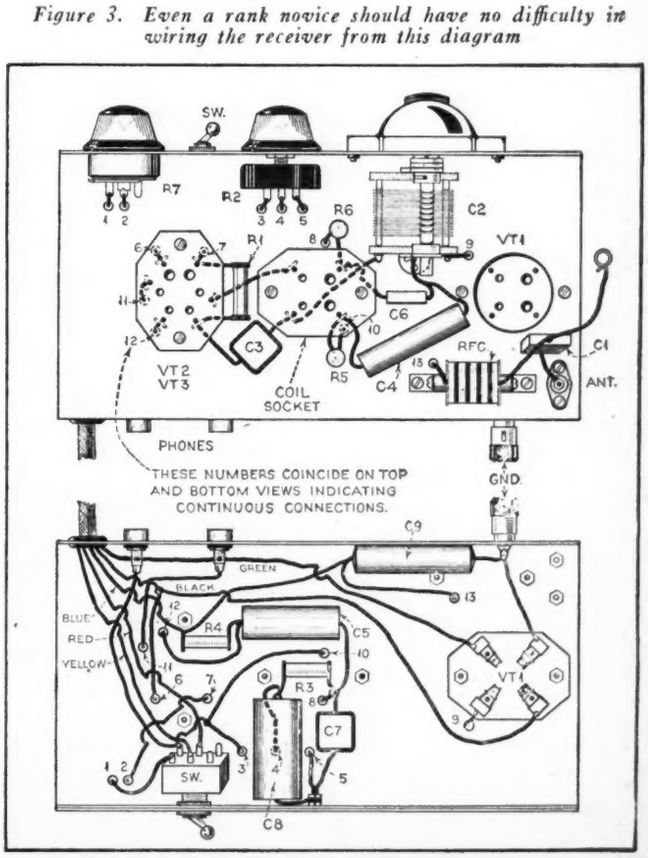
Before going into the constructional details of the receiver it may be well to briefly analyze the circuit of Figure 2. RFC is an 8 millihenry r.f. choke which was selected, after trying different values of resistance and also smaller chokes, because it was found to provide somewhat greater signal strength. This choke is connected to the C battery, and the condenser C9 is employed to by-pass the battery. C1 is included in the antenna circuit solely as a safeguard to prevent shorting (*Continued on page* 119)

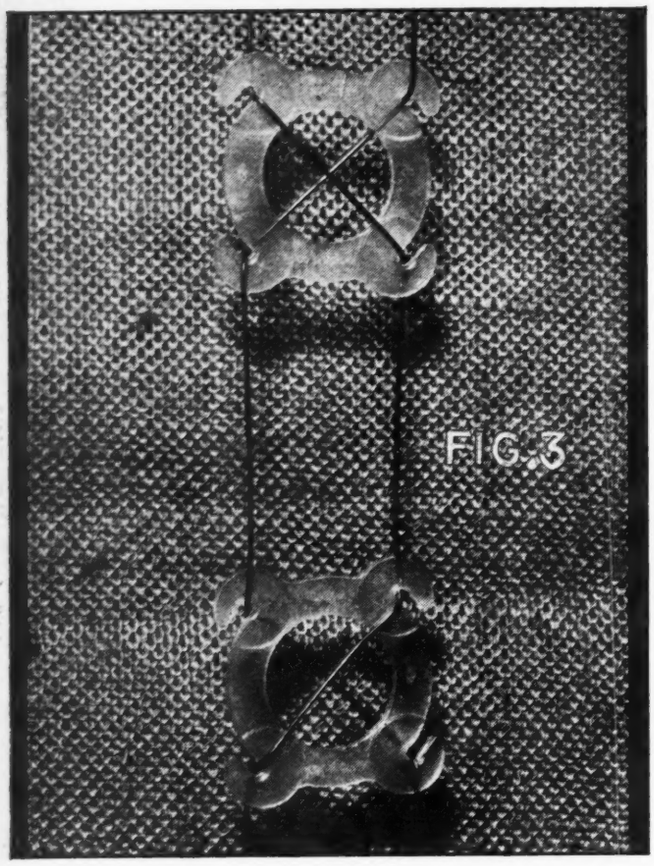




THE PICTORIAL DIAGRAM

Figure 3. Even a rank novice should have no difficulty in wiring the receiver from this diagram





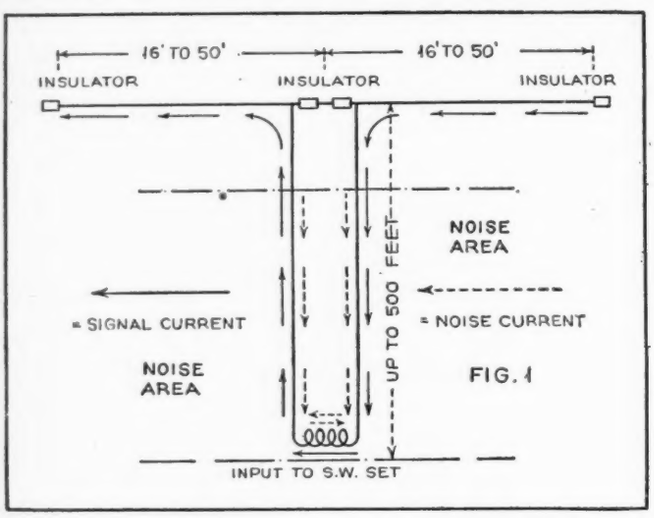


FIG. 1

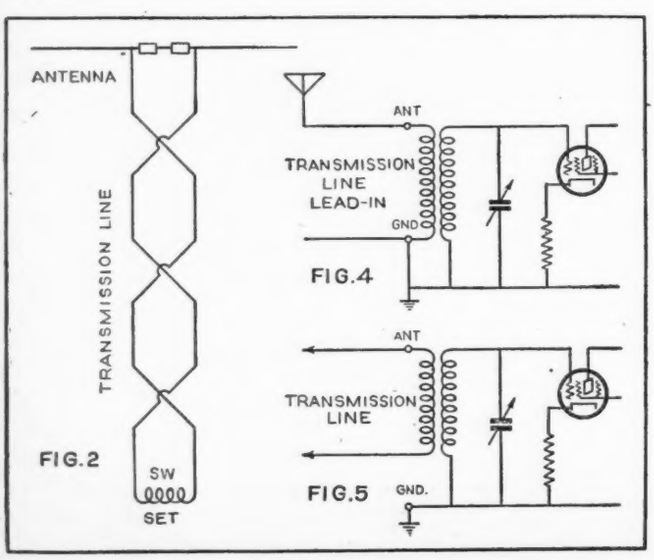


FIG.2

FIG.4

FIG.5

GETTING ACQUAINTED *with* SHORT WAVES

(ABC of Short-Wave Aerials)

This, the eighth installment, contains valuable information on the properties of antennas and methods to reduce noise

James Millen

IT might seem that there has been enough written and said about antennas in general, and short-wave aerials in particular, to preclude the necessity for repetition in this series for the beginner. Unfortunately, much of the material which has previously been published has been sales promotional, rather than directed toward an impartial analysis of the requirements of average short-wave reception. Also, the majority of such articles have assumed a degree of technical knowledge on the part of the reader somewhat beyond that of the hundreds of broadcast fans who are daily looking to short waves for new worlds to conquer. No series of short-wave articles, dedicated to the beginner, would be complete without consideration of the antenna problem. In no instance can one take full advantage of the possibilities inherent in any short-wave receiver—from the elementary types to the elaborate multi-tube superheterodynes—unless the antenna is pretty well what it should be.

In the case of the simple receiver—the one- and two-tube affairs—a great deal necessarily depends on the character of the signal input, which in turn is an antenna problem. And the greater efficiency engineered into complicated receivers, as the number of tubes increases, cannot be touched unless the signal well overrides the noise pick-up—which again is a function of the aerial system.

A good broadcast antenna will, in many instances, give entirely satisfactory operation with a short-wave set. Such an aerial, however, will almost invariably be a reasonably long outside antenna—75 to 150 feet—swung high and clear, well insulated, soldered joints—a clean job from tip through lead-in. If you believe your antenna falls into this class—or that such an aerial can be easily erected—by all means try it before experimenting with the somewhat more complicated types. An exception to this advice is in apartment houses, where, regardless of how well the lead-in may be installed, it will be practically certain to run through a noise-infested area.

Broadcast antennas, which will not give good short-wave results, are those employing noise-reduction systems designed for operation between 200 and 600 meters and, in most cases, indoor aerials. (Again, an exception. Indoor aerials sometimes give good results in rural districts. But in such cases, an outdoor antenna is easily erected, and advantage should be taken of the superior results accompanying an open installation.)

The long-wave noise-reduction systems usually employ a twisted transmission lead-in, or a shielded cable. There is a pronounced condenser effect between the two leads, on the one hand, and the lead and shielded cable on the other. However, this capacity effect is not important with broadcast reception. But with the high frequencies of short-wave work, the effect of capacity may be considered as shorting out the signal.

Our general comment against the efficiency of the twisted lead-in for short-wave work should not be held condemnatory of all systems falling in this category—such as the R. C. A. "Wide World" antenna and the Lynch "Giant Killer," which are especially engineered, in reference to correct length and impedance, to minimize such losses by balancing, etc.

Indoor antennas are unsatisfactory from the point of view of noise. This is because the entire system is located within a noise area. These noises are caused by radiations from

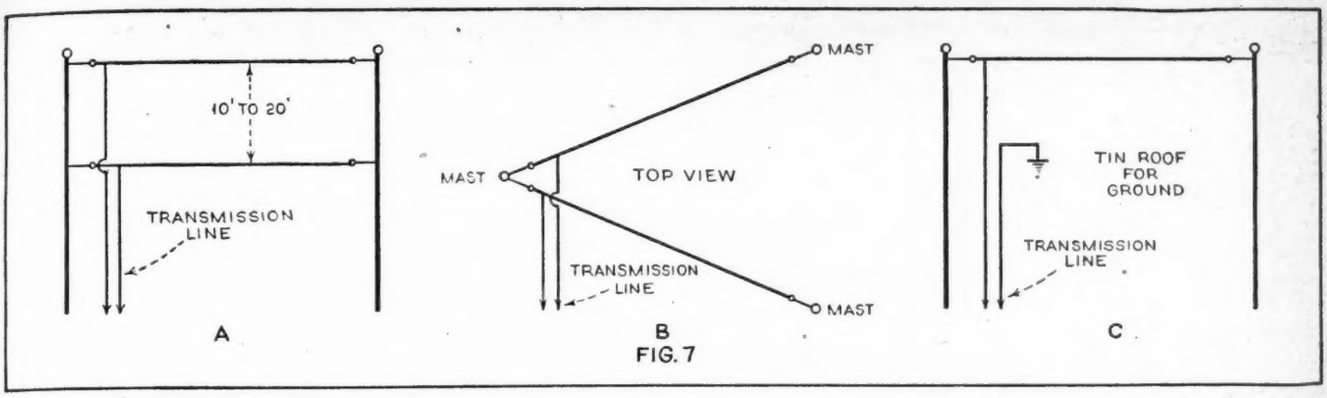


FIG. 7

vacuum cleaners, violet ray machines, elevators, electrical refrigerators, incinerators, oil furnaces, dial telephones, etc. Such appliances need not necessarily be used in the apartment or home where the short-wave set is installed. The interference they cause is often conducted, like "wired wireless," by telephone and electric light wires, and radiated all along the route. Noise interference is much more noticeable on short waves, due to the fact that the disturbance is of a very high frequency. The broadcast receiver does not tune down to it efficiently.

The noise level on s.w. foreign stations should be less than that accompanying long-distance reception on the long-wave band. If you believe you are being bothered by more than the normal amount of back-ground noise, it is a good idea to consult someone experienced with short-wave reception, for his opinion.

Using a broadcast antenna, the background noise can be reduced somewhat by lengthening the aerial. Always assuming that the antenna is out of the noise area, this will increase your signal pick-up more than the noise pick-up. Adding more feet to the aerial will, of course, increase the capacity between aerial and ground. This capacity acts as a small condenser across the antenna primary in the receiver which may boost its natural wavelength to an undesirable degree. In such cases it is necessary to put a small condenser in the lead-in, close to the set. This should be preferably of the variable air-dielectric type—the so-called midget or trimming condenser—having a maximum capacity of from 35 to 90 microfarads.

Lengthening the aerial may also result in broad tuning. This may be explained by the fact that with the short antenna the volume control is turned higher for a given output from a certain station. Practically all volume-control systems increase regeneration to some extent as the control is turned up. And, as we discovered in previous articles in this series, increased regeneration is accompanied wtih improved selectivity.

If the complaint of poor reception on the broadcast antenna is other than noise, the trouble probably is with the short-wave set itself—not the antenna. However, if background noise is excessive, the only cure is recourse to a noise-reduction antenna system.

What we really mean by noise reduction is the increase in the signal-to-noise ratio. As implied above, this can be accomplished in either one or a combination of two ways—by increasing the signal pick-up and by decreasing the noise pick-up. This may be illustrated by an ideal problem.

We assume that our antenna picks up only signal and the lead-in picks up both signal and noise. (The ordinary lead-in picks up quite a bit of signal.) If we substitute a lead-in which picks up nothing at all, we shall have increased our signal-to-noise ratio enormously! Of course we shall have lost a bit of signal strength, due to the elimination of lead-in pick-up, but the volume control can now be turned up to compensate this. However, if the sensitivity of the set is insufficient to make up for this loss, we can increase the length of the antenna—which is usually a good idea, unless a particular length is desired, as will be mentioned farther on.

As predicated, the problem just considered is an ideal one. In actual practice the situation is as follows: The antenna pick-up on a given signal may have a signal-to-noise ratio of say fifteen to one, while the lead-in has a *noise-to-signal* ratio of perhaps thirty to one. The combination may well result in the noise being much louder than the signal, and reception is impossible. We now install a lead-in which picks up practically no noise, nor signal, and the result is we have a signal-to-noise ratio of fifteen to one. If we wish, we may lengthen the aerial, compensating the loss in signal pick-up by the lead-in—probably without material change in the signal-to-noise ratio. However, if the aerial is extended toward a noise area, the signal-to-noise ratio will naturally be lowered, and if away from a noise area, the ratio will be increased.

The transmission line provides a form of lead-in which picks up neither signal nor noise, which is economical, easy to install and widely used for short- and all-wave reception. Its noise-reduction qualities are effective as high as 600 meters.

Inspection of Figure 1 will indicate the manner in which the transmission line functions. This illustrates the "doublet" antenna—so named because of the two equal stretches of aerial on each side of the double lead-in. We shall assume that at a given instant a signal current is induced in the antenna which follows the direction of the arrows drawn in solid lines. This current goes *down* one lead-in, through the antenna primary of the receiver, and *up* the other lead-in, following along its original direction on the left-hand portion of the horizontal wire. Noise pick-up by the antenna will follow a similar course and be heard in the receiver. If the antenna is well located, the noise impulses will be very weak in comparison with the signal. In other words, we have a high signal-to-noise ratio.

The very powerful noise impulses in the section indicated as "noise area," through which the lead-in passes, will take the same direction, *in both lead-ins,* as indicated by the dotted arrows. Meeting in the antenna primary, they neutralize (buck each other) and become non-existent as far as the receiver is concerned. Similarly, any signals picked up by the lead-ins will have no effect on reception. (*Continued on page* 115)

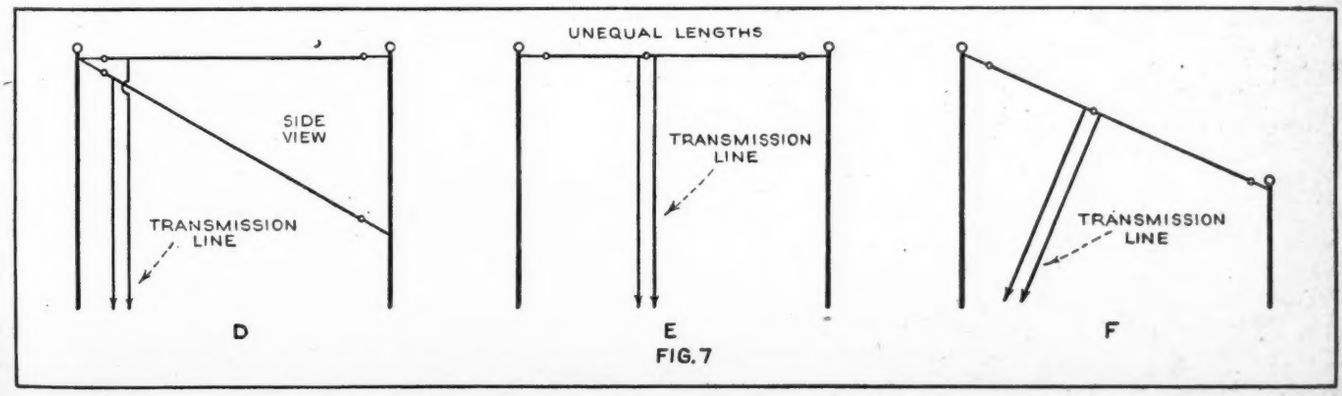
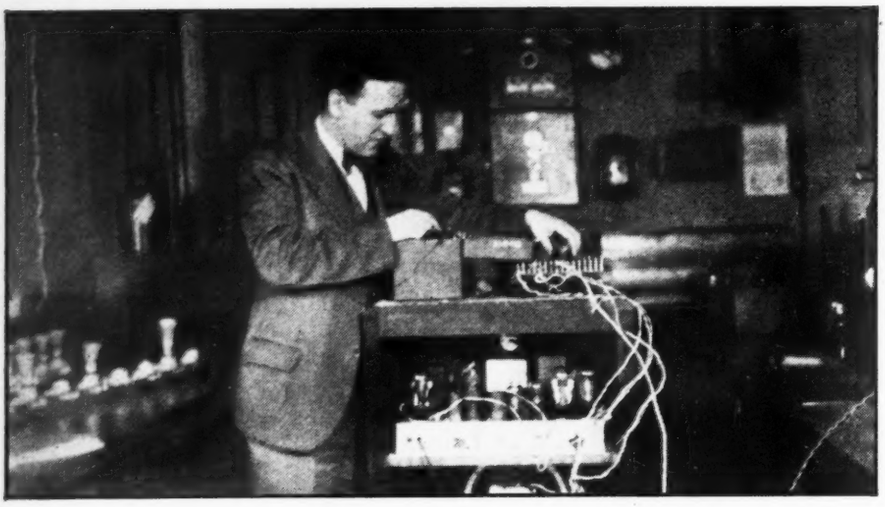


FIG. 7



Giving Receivers RATING TESTS

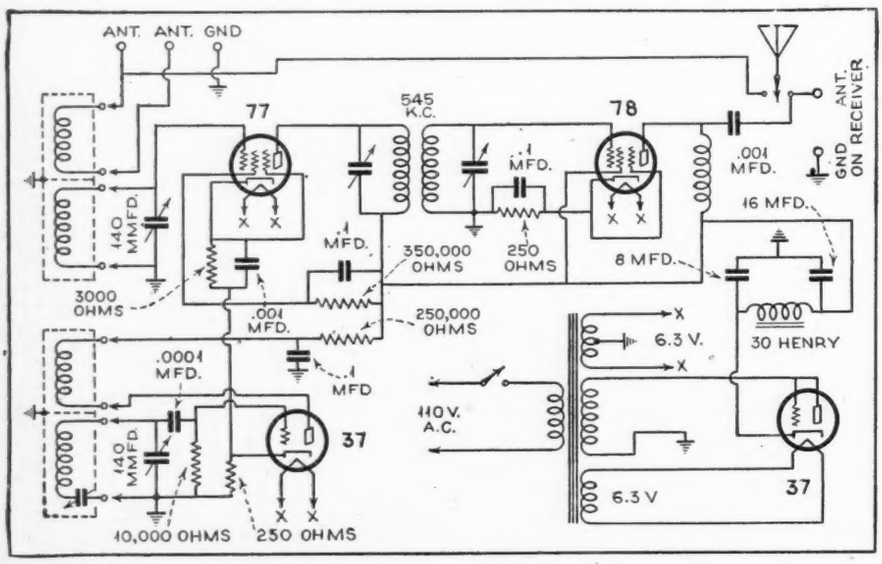
J. W. Fulmer*

DEVELOPMENT in the radio industry, unlike that in many anotner industry, has been the result of experiment and research on the part, not only of scientists and engineers, but on the part of amateurs as well. Hardly had the works of such eminent scientists as Hertz, Marconi, DeForest, Alexanderson and others mainly responsible for the early development of radio appeared in published form than amateurs, possessing a lesser understanding of the principles of this new art, attempted to and succeeded in demonstrating its practicability. Much of such experimentation was done by the personnel of commercial ship and shore stations and much by enthusiastic amateurs eager to transmit to friends a few miles distant.

Through foresight and the experience of others, the commercial operator knew that it was hazardous to contact with the circuits of his high-powered transmitter. In the commercial stations, the hazard was reduced to a considerable extent by the use of apparatus which sounded and recorded alarms indicating dangerous operating conditions of the various pieces of equipment previous to the functioning of the automatic overload protective devices. Likewise, in the radio amateur stations, a certain amount of control was given to the apparatus. To a large extent this was personal supervision, added to the fact that more often than not, the receiver at least was battery-operated, involving relatively small amounts of energy.

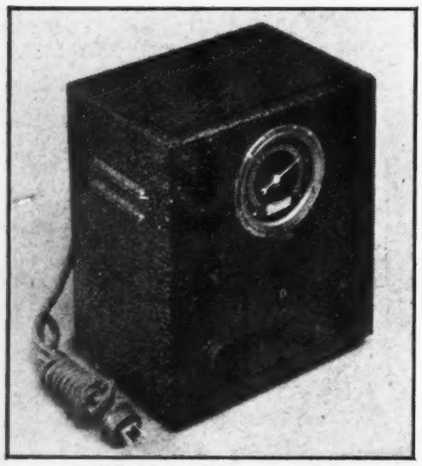
Somewhere around 1920, commercial organizations began to experiment with the new art of radio telephony, and it was realized that substantial sales possibilities could be realized through this medium. The sponsors of this development found it necessary to provide radio stations (*Continued on page* 126)

* Underwriters Laboratories



Makes Any Set "ALL-WAVE"

(*S. W. Converter*)



THE short-wave converter shown in the accompanying photograph and circuit offers a highly practical device for those who have developed a desire to be able to tune in the domestic and foreign short-wave programs, but who are unwilling or financially unable to discard their present broadcast receivers in favor of all-wave sets.

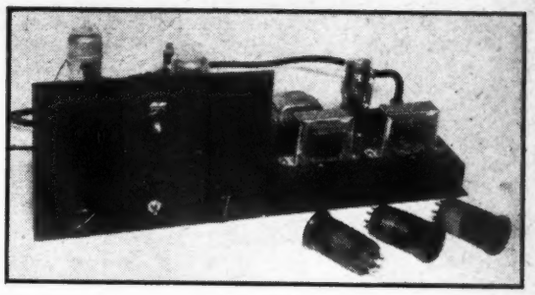
This Postal converter incorporates several features which lift it above the ordinary run of such units. No changes whatsoever have to be made in the broadcast receiver. The converter is simply connected to the antenna and the shielded output lead is connected to the antenna binding post of the broadcast receiver. Thereafter a switch on the converter panel permits the antenna to be connected to the converter or to the broadcast set, depending upon whether short-wave or broadcast reception is desired at the moment.

The shielding of the converter is unusually complete, minimizing the possibility of the broadcast receiver picking up broadcast stations through the wiring of the converter—a condition which would result in undesirable heterodynes in many cases. The device has its own power supply built in, operating direct from the a.c. line.

The accompanying circuit diagram will convey a definite idea of the design. A 77 detector and 37 oscillator, coupled through their cathode circuits, coupled the conversion circuit. The output of the detector is then fed to a 78 i.f. stage, tuned to 545 kc., and the output of this amplifier tube is fed to the broadcast receiver which is, of course, permanently tuned to this same frequency while using the converter. The inclusion of an i.f. amplifier tube in the converter isolates the conversion circuit from the broadcast receiver circuits and thus prevents undesirable interaction between the two (where the latter is a superheterodyne) and prevents the input circuit of the broadcast receiver from in any way affecting the operation of the conversion (*Cont'd on page* 126)

Low-Cost A. C. Operated

SHORT-WAVE KIT



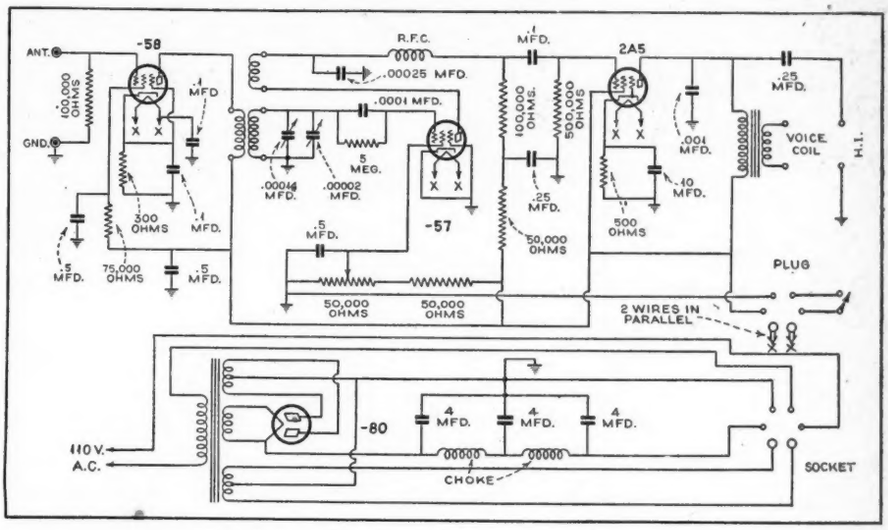
H. L. Shortt

WITH few exceptions, the available short-wave receivers have been either elaborate and expensive superheterodynes or small battery-operated outfits. Many prospective short-wave listeners have been discouraged by the price of the former and the patience required to operate the latter.

The Lafayette "Trophy-Winner" bridges the gap between the small and large sets. It employs four tubes, including the rectifier; the highly efficient a.c.-operated pentodes make it possible to receive foreign short-wave stations on the loudspeaker. The parts are available in kit form, which comes with complete instructions, requiring no experience to assemble and wire.

The receiver covers the range from 15 to 200 meters in four overlapping bands, employing plug-in coils of special design. Ranges for the individual coils are: 15-36 meters, 34-65 meters, 62-115 meters and 110-200 meters.

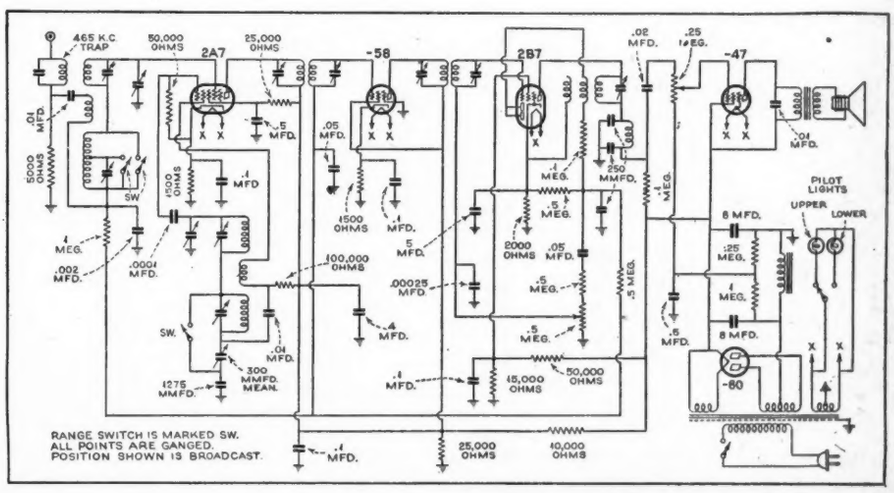
Figure 1 shows a schematic diagram of the circuit with the values of condensers and (*Continued on page* 125)



A Highly Practical

DUAL-RANGE SUPER

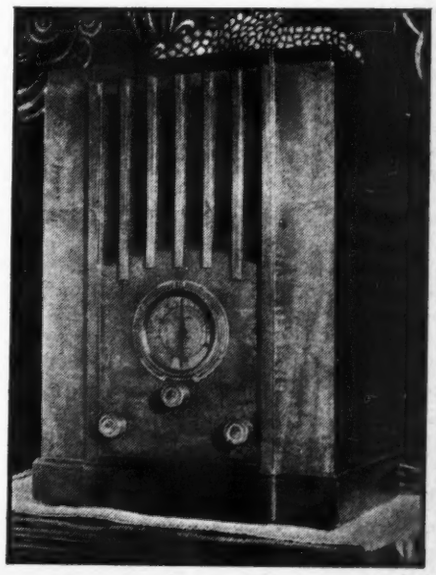
(Emerson, Models D-S5 and 39)



TO the average short-wave listener the frequency band between 1500 kilocycles and 20,000 kilocycles has only a limited number of interesting spots, while there are wide stretches on the dial which contain few stations which he considers worth listening to. When we survey the entire frequency spectrum, it will be found that nearly all points of interest to the s.w. broadcast fan can be found within the range bounded by the 19-meter broadcast band and the 50-meter broadcast band. Fortunately it is possible to gather nearly all these points of interest and unite them in a single range. A receiver covering the regular broadcast band and this "short-wave band of most interest" will satisfy the great majority of prospective short-wave listeners, and permits the manufacturer to simplify his design greatly, thereby making the receiver less complicated and less costly.

The Emerson receiver described here covers the two ranges referred to above, the broadcast range extending from 540 to 1500 kilocycles and the short-wave range from 5500 to 16,200 kilocycles (55-18.5 meters). This short-wave range includes four broadcast bands near 19, 25, 31 and 49 meters. It also includes the 20- and 40-meter amateur bands as well as a great number of frequencies assigned to commercial telephone service.

The receiver employs five tubes of the following types and purposes: a type 2A7 serves as a combination oscillator and detector; this is followed by a stage of intermediate-frequency amplification employing the 58 type tube. The second-stage of intermediate-frequency amplification, the detection, the automatic volume control and first stage of audio-frequency amplification are all united in a single tube, the versatile 2B7. The output tube is a type 47 and the 80 is employed as a rectifier. The circuit is shown in Figure 1. This is one of the first successful applications of the reflex principle employing the 2B7. The pentode section serves as the second (*Continued on page* 125)



QUALITY WITH ECONOMY *in* *ALL-WAVE* SET DESIGN

McMurdo Silver

Part One

IN undertaking the design of an all-wave receiver, keeping a weather eye on cost and including no extras not vitally essential to a high level of performance, the initial requirements are as follows:

(a) Sufficient sensitivity to insure reaching the lowest residential noise level.

(b) Absolute 10 kc. selectivity.

(c) Fidelity flat within 6 db. over the range of 30 to 4000 cycles.

(d) Sufficient undistorted power output to give ample home entertainment volume without overloading.

(e) Lowest possible inherent noise level in order not to vitiate the necessarily high sensitivity.

(f) Full coverage of the entire broadcast range of 540 to 23,000 kilocycles.

(g) Ease of operation and dependability.

In order to meet requirements (a) of sensitivity in an all-wave superheterodyne, a first detector and oscillator of high gain will be needed, at least two i.f. stages, second detector, automatic volume control to minimize fading of weak stations, and two audio stages, unless output pentodes are to be used, which is not permissible in terms of tone-quality requirements.

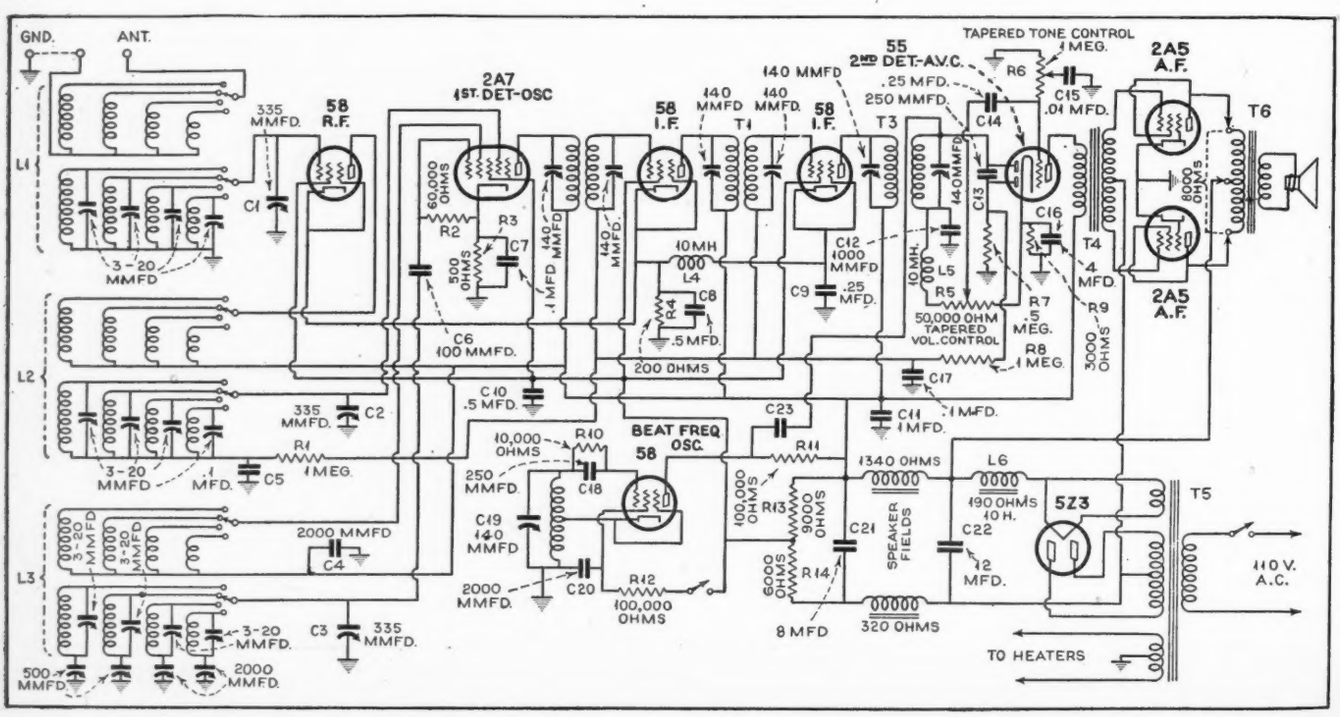
To meet requirement (b) of selectivity, two problems must be considered. Adjacent channel selectivity will necessitate at least 6 tuned i.f. circuits, as in 2 dual tuned i.f. stages. A high intermediate frequency is required in order to make image rejection as easy as possible for the input circuits.

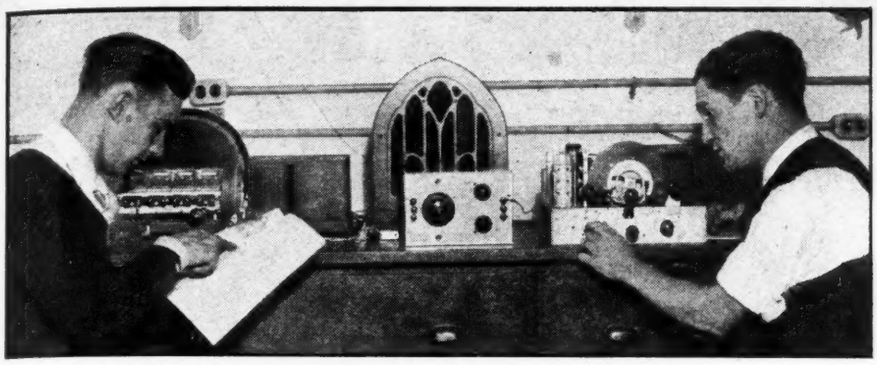
Requirement (c) of good audio fidelity necessitates not only good audio design and compensation for r.f. and i.f. side-band cutting, but it necessitates a Class A or preferably Class A prime power-output stage. It will also necessitate a diode second detector, rather than a 3-element triode, for elimination of the second detector distortion. If a necessarily low-gain but high-quality Class A or A prime output stage is used, it must be preceded by a combination voltage amplifier and power-driver stage.

Requirement (d) of good power output can be met only by a well designed Class A or A prime output stage not skimped on transformer size or available voltage.

Requirement (e) of low inherent noise, is most stringent. Noise inherent in a receiver design may originate in a number of ways, but assuming competent design and high-quality tubes and parts, its sources may be localized. The frequency conversion effected by the first detector and oscillator will produce some tube hiss, which can be minimized by operating these circuits at as high a signal level as possible. This can be accomplished by the use of a tuned r.f. stage preceding the first detector, which will not only be helpful in reducing image interference as previously indicated, but from which sufficient amplification can be obtained to permit frequency conversion to occur, even on very weak signals, at a level sufficiently high to eliminate oscillator hiss. With this done, the remaining noise will be entirely a function of overall gain showing up thermal agitation noise in input circuits and in input tubes. This is the final limitation of usable gain or sensitivity in a radio receiver. The answer is to strive for a sensitivity of between ½ and 1½ microvolts absolute—more than this is likely to result in excessive noise with no appreciable gain in signal pickup, while less than this loses signals that would

(*Continued on page* 123)





THE DX CORNER

FOR BROADCAST WAVES

APPLICATIONS are now being received for Official Listening Post appointments. It is our desire to make one (or more in larger states) appointment in each state and in foreign countries as well. Anyone of proven DX ability, who is willing to send in monthly reports on his reception, is eligible for consideration. Appointments will be made beginning in the early Fall. If you desire such an appointment, address your application to this department and in it provide information concerning your DX experience and any other information which will be he helpful in the consideration of your application.

Broadcast Station Changes

Among the changes recently announced by the Federal Radio Commission are:

WJJD, Mooseheart, Ill., granted permission to go on the air daily at 5 a.m., C.S.T., until August 1, 1934.

KTRH, Houston, Texas, to operate on 630 kc., May 1 to October 1, using 250 watts power at night and 1000 watts during the day.

KFPY, Spokane, Wash., to operate on 890 kc. instead of 1340 kc., using 1000 watts, full time.

KGIR, Butte, Mont., shifts frequency from 1360 kc. to 1340 kc.; 1000 watts daytime, 500 watts night, full time.

WLAP, Lexington, Ky., shifts frequency from 1200 to 1420 kc.

WCBS, Charleston, W. Va., increases day power from 500 watts to 1000 watts.

WPRO, Providence, R. I., experimental operation on 630 kc., 250 watts, to December 1.

WORC, Worcester, Mass., experimental operation on 1280 kc., 500 watts.

WISN, Milwaukee, Wis., now operates full time on 1120 kc., daytime; power increased from 20 to 500 watts, night power 250 watts.

KOA, Denver, Colo., increases power to 500 watts, unlimited time, 830 kc.

KARK, Little Rock, Ark., increases daytime power from 250 watts to 500 watts.

WHN, New York City, increases power from 250 watts to 1000 watts.

WDNC, Durham, N. C., moving station from Wilmington to Durham and shifts frequency from 1370 kc. to 1500 kc., using 100 watts, full time.

KFAC, Los Angeles, Calif., increases operating hours from half time to full time, using 1000 watts on 1300 kc.

WALA (formerly WODX), Mobile, Ala., shifts frequency from 1410 kc. to 1380 kc., and changes from part-time to full-time operation with 500 watts.

WSFA, Montgomery, Ala., changes operating hours from part time to full time, 1410 kc.

KROW, Oakland, Cal., changes operating hours from part time to full time, operating on 930 kc., 500 watts night and 1000 watts daytime.

KFH, Wichita, Kansas, increases operating hours from part time to full time.

HIJK, Dominican Republic

Rudolph Kure, Cincinnati, Ohio, writes that, according to information received from the American Consul at Santo Domingo, Dominican Republic, there is no such station as HIJK, which was given in the June list in RADIO NEWS as operating on 1180 kc. with 15 kw. power. It appears that this was at one time the call of the station which is now known as HIJ. It operates on 1195 kc. instead of 1180, and with 15 watts instead of 15 kilowatts. You DX'ers who have been trying for this mythical high-power Central American station now know the reason for the failure. The only D. R. station using more than 15 watts power is HIX, 1580 kc. This station is a 1000-watter and is on the air (also with 200 watts on 50 meters) Tuesdays and Fridays, 8:30 p.m. to 10 p.m.; Sundays, 8:30 a.m. to 10 a.m. and 3 p.m. to 5 p.m.

XENT, Nuevo Laredo, Mexico

Reports from California indicate that this station, supposedly operating on 1115 kc., has shifted frequency somewhat, with the result that it now seriously heterodynes KRKD, a 500-watt station at Los Angeles which operates on 1120 kc. This report comes from the radio column conducted by Nathan Columbus in *The Harbor Worker*, a San Pedro, California, paper.

From a Brazilian DX'er

Louis Rogers Gray, Petropolis, Rio de Janeiro, Brazil, submits a report on DX reception in his part of the globe. Not the least interesting part of this report is the discrepancy between the frequencies he gives for some of the South American stations and those published in the June issue of RADIO NEWS. The frequencies published in the June stations list were furnished by the various South American governments and were therefore assumed to be correct. However, here is a DX fan right on the ground whose report does not check with the government reports, which may indicate either that the governments concerned are not very careful in preparing the information they send out, or that some of the South American stations are indulging in the old U. S. custom of picking their own frequencies. Mr. Gray states that there may be small discrepancies in the frequencies shown in his report, due to the fact that the dial calibration of his receiver is not exactly accurate. This, however, could presumably account for differences of only a few kilocycles.

The following is quoted from Mr. Gray's report:

"I am sending you a list of broadcast stations logged between January and April, 1934, with a Philco Model 90 superhet and a 120-foot antenna.

"None of the American stations has been any good during April, but during our summer (winter in North America) they could be heard any night, when the static was not too bad, after 9:30 p.m. WEAF and WSB were the best. I have been unable to pick up the new 500,000-watt Crosley station, but so far I have only tried about 6 a.m.

"Of the Rio stations, PRC6, PRA9 and PRA3 are the best, but none uses over 2000 watts, I believe. As I am only 35 miles away from Rio, I get them all good, of course. Sao Paulo has stations which are as good or better than Rio. PRB9 is the best. PRC7, Bello Horizonte, is also very good. All the Brazilian stations are low-power ones.

"Several of the Argentine stations are excellent at times, sometimes even stronger than Rio. LR4, LR5, LR3 and LSB are the best. They also have far better programs than the Brazilian ones. CP4, La Paz, and CX26, Montevideo, are not much good, but the latter is fair at times.

"Reception during the summer here is very erratic, but now that winter is near, it will probably settle down. The best months for reception here are June, July and August, although they are no good for the U. S. A. stations.

"I hope this log may be of interest, as so far I have seen no broadcast report from South America in your DX Corner."

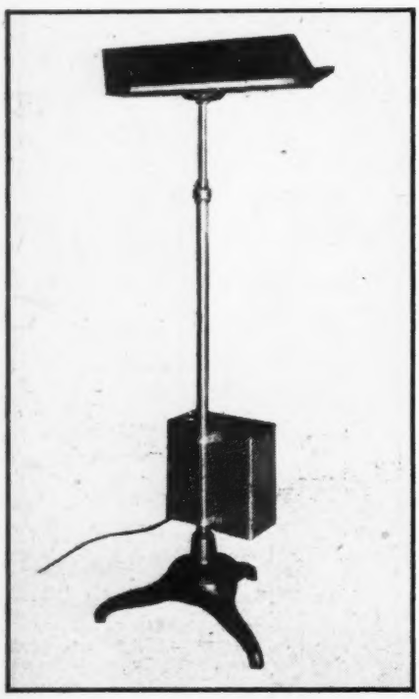
Mr. Gray's Log

Freq.	*Call*	*Location*
660	WEAF	New York, N. Y.
675	LS4	Buenos Aires, Arg (Telefunken)
700	WLW	Cincinnati, O.
710	WOR	Newark, N. J.
750	PRA2	Rio de Janeiro (Radio Sociedad de Rio de Janiero)
760	WJZ	New York, N. Y.
855	PRB7	Rio de Janeiro (Radio Educadora do Brasil)
820	PRA6	Sao Paulo (Radio Educadora Paulista)
830	LR5	Buenos Aires (Radio Excelsior)
870	PRA3	Rio de Janeiro (Radio Club do Brasil)
890	PRB4	Sao Paulo
930	LR2	Buenos Aires (Radio Prieto)
935	PRD2	Rio de Janeiro (Radio Cruzeiro do Sul)
960	LR3	Buenos Aires (Radio Nacional)
970	PRC6	Rio de Janeiro (Radio Philippe)
990	LR4	Buenos Aires (Radio Splendid)
1000	WOC	Des Moines, Ia.
1010	PRB9	Sao Paulo (Radio Sociedad Record)
1030	LR9	Buenos Aires (Radio Fenix)
1050	PRC8	Rio de Janeiro (Radio Guanabara)
1050	CP4	La Paz, Bolivia
1055	CX26	Montevideo, Uruguay
1140	PRA9	Rio de Janeiro (Radio Sociedade Mayrink Veiga)
1080	LS3	Buenos Aires (Radio Mayo)
1090	PRC7	Bello Horizonte, Minas Geraes (A Voz de Minas)
1150	PRB2	Curityba, Parana (Radio Sociedade Paranaense)
1160	PRB6	Sao Paulo (Sociedade Rio Radio Cruzeiro do Sul)
1170	PRA7	Ribeirao Preto, Sao Paulo
1230	LS8	Buenos Aires (Radio Sarmiento)
1260	LS9	Buenos Aires (La Voz del Aire)
1310	PRA5	Ribeirao Preto, Sao Paulo (Radio Sociedade do Ribeirao Preto)
1370	PRD5	Rio de Janeiro (Ministerio de Educacao)
1380	PRD7	Petropolis (Radio Petropolitana)

A New Chain

John C. Kalmbach, Buffalo, N. Y., writes that a new radio network has been formed, known as The North American Broadcasting System, which includes the following stations:

Call	*Location*	*Freq. (Kc.)*	*Power, (Kw.)*
WHAD	Milwaukee, Wis.	1120	.25
WCLO	Janesville, Wis.	1200	.1
WHBY	Green Bay, Wis.	1200	.1
WOMT	Manitowac, Wis.	1210	.1
WIBU	Poynette, Wis.	1210	.1
WRHM	Minneapolis, Minn.	1250	1.0
WTAQ	Eau Claire, Wis.	1330	1.0
WKBH	La Crosse, Wis.	1380	.1
WHBL	Sheboygan, Wis.	1410	.5



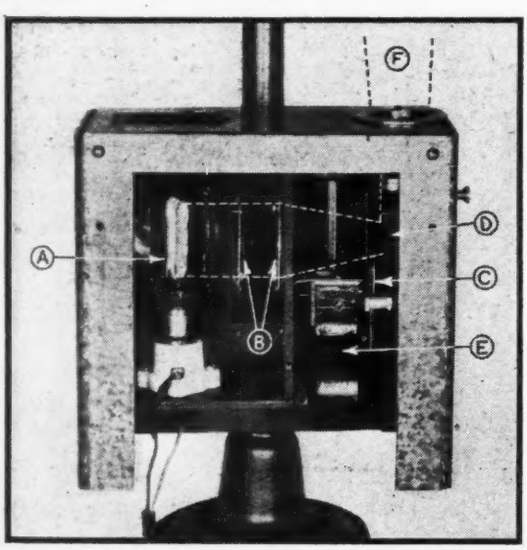
A Visual VOLUME CONTROL

Samuel Kaufman

A NEW projector type of volume indicator for broadcast studio and concert hall use has been designed by engineers of Station WCAU, Philadelphia. At the suggestion of Leopold Stokowski, conductor of the Philadelphia Orchestra, now heard on a CBS series from the studios of WCAU, the engineers developed a special visual indicator of sound intensity which dispenses with the customary "needle" meter used by symphony conductors. The new device makes it possible for the conductor to keep his eyes raised instead of constantly lowered to the needle indicator. The WCAU device was developed by John G. Leitch, technical supervisor, and Ivan Ivanovitch Eremeeff, research engineer. No plans were made at the time of this writing to produce the device commercially, but it was indicated that the instrument may be made available to other stations if any sizable demand arises.

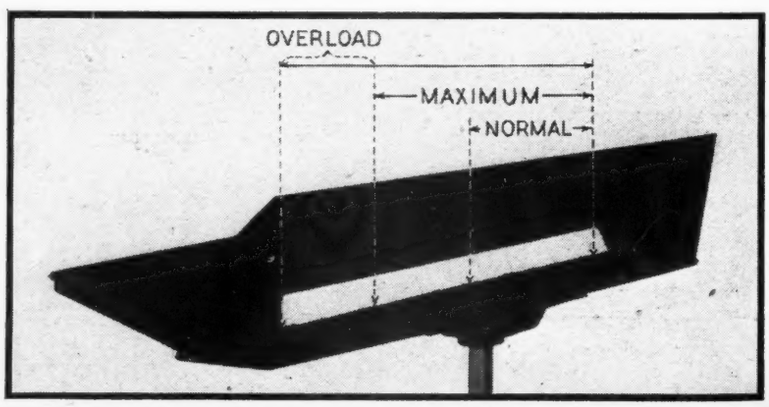
One of the chief advantages of the indicator is that it is visible throughout the entire studio, so that musicians, production men and others, in addition to the conductor, participating in the program's presentation, can observe the sound intensity.

The device (*Continued on next page*)



STOKOWSKI SUGGESTED THIS IDEA

The well-known conductor, shown leading the Philadelphia Symphony Orchestra, suggested the development of the device shown herewith. At the left is the control projector unit, which is mounted on the shaft of the indicator stand. A is the light source, B are condensing lenses, C is the light shutter, D is the prism, E is the controlling "motor" and F is the light beam projected up to the strip screen. The photograph below shows this strip screen and how the volume may be watched by the conductor



is attached to the conductor's music stand. A galvanometer and projector, with a special reflector and shutter arrangement, is attached to the base of the stand. The sound intensity is then registered by a band of light that is projected upwards to two horizontal glass screen strips stretching across the music rack. The glass strips are placed together at an obtuse angle so that the single beam of light is projected on both strips simultaneously. The widening and contracting of the projected beam then indicate the sound intensity. The indicator can be observed from either side of the music stand. The light changes in color to indicate variations in volume. A 500-watt projector lamp in a box on the base is used as the light source. This light is focused by a glass prism and projected through a mechanical shutter up to the top of the music stand. The shutter is controlled by a galvanometer. As the shutter opens wider or closes, the band of light on the glass screen widens and contracts. Through the use of colored mica on parts of the shutter, the light on the screen varies in hue to indicate specific sound intensity measurements. The colors include yellow, blue, green and red, the last of which indicates "overloading."

WCAU and CBS engineers term the device a success, and Stokowski, too, is elated over its practicality and helpfulness.

Radio Research

(*Continued from page* 71)

New radio devices, unthought of in 1933, are making their appearance. Improvements all along the line, in tubes, in all-wave and short-wave receivers, in loudspeakers, in public-address and all kinds of electronic equipment, as well as in laboratory and service measuring apparatus, are making themselves evident. This issue of the magazine (and ones to follow) are especially dedicated to Big Things in Radio that mean a healthy outlook for the future of the industry and even greater satisfaction for all classes of radio users. A careful perusal of the articles in these issues will bring to light a number of new things in which you are bound to be interested.

Checking Time

(*Continued from page* 80)

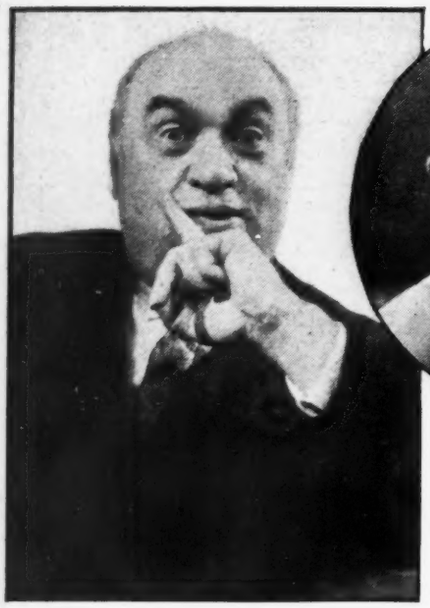
the watch's accuracy. The scale measures this angle and is calibrated to read in fractions of a second of time, each division representing one-sixtieth of a second for the watch under test.

When it is desired to listen to the tick, a switch is thrown to the "listening" position, which connects a loudspeaker across the amplifier, instead of the neon light. Sounds which, by ear alone could not be detected, are instantly available for study by this method.

The chronograph and chronoscope were designed primarily for watch factories and repair laboratories. An added utility is seen in their showroom application whereby prospective purchasers can be shown simply and indisputably the working differences in various types of timepieces.

Charge Radio and Cable Monopoly

WASHINGTON—A charge that a "monopoly" controls radio and cable service across the Atlantic was recently made in Congress by G. M. P. Murphy, chairman of the Radio and Cable Users Protective Association.



NIKITA BALIEFF

MADY CHRISTIANS

JOHN B. KENNEDY

MAX BAER

BACKSTAGE *in* BROADCASTING

Chatty Bits on Radio Personalities

Samuel Kaufman

WITH Al Jolson taking a seasonal holiday from the Thursday night Kraft hour of NBC, the program has undergone considerable change. The feature, which was named "Paul Whiteman's Music Hall" several weeks ago, added new artists during the Spring months. Nikita Balieff, the Russian creator of the "Chauve-Souris" stage sensation, made his microphone début on the series and it was intended to keep him on the feature for a lengthy period. Another addition was Lee Wiley, the songster featured on many stellar network presentations for several seasons. Deems Taylor continued as narrator and, of course, the instrumental portion of the program was still supplied by Paul Whiteman's impeccable organization.

MADY CHRISTIANS, the German actress recently added to the permanent cast of the Big Show, heard Mondays over CBS, is a protegée of Max Reinhardt and is said to be the first radio artist to espouse the dramatic technique of the famous European impresario for American radio listeners. Miss Christians holds that radio acting provides a perfect exercise in dramatic control, and that the requirements of playing entirely to the ear calls for the development of "the science of vocal acting." She appeared in several European cinema and stage presentations. She is cofeatured on the CBS series with Gertrude Neisen, songster, and Erno Rapee's orchestra.

AS soon as Max Baer signed for a championship match with Primo Carnera, he was recruited by NBC scouts for one of the most unusual broadcast series ever presented. Early last May he started his rôle in the "Taxi" series presented thrice weekly from his Asbury Park, New Jersey, training camp. The boxer was supported by a large dramatic cast which moved out to the training camp for the six-week series. The dramatic action of the series led up to the actual championship fight. The B. F. Goodrich Company sponsored the unique series.

HARRY RICHMAN, singing star of many musical comedy hits, has returned to the airlanes as star of the Conoco series. heard Wednesdays over NBC. He is co-featured with John B. Kennedy and Jack Denny's Orchestra. Richman's early appearances on the series caused the sponsor to sign him up for the remainder of 1934. Kennedy, a former magazine editor who established an excellent reputation as a radio commentator, presents on each program a brief description of some forthcoming event of wide interest. Denny's Orchestra is well known to listeners of both the NBC and CBS.

FLOYD GIBBONS, radio's famous "Headline Hunter," after a long absence from the microphone, recently returned to NBC as star of a Saturday night series sponsored by the Johns-Manville Company. In his radio talks, he devotes special attention to affairs of the Capital City. Nathaniel Shilkret's orchestra supplies a background of martial airs.

EVERETT MARSHALL, opera and musical comedy baritone, is the new star of the Broadway Melodies series sponsored by the Bi-So-Dol Company Wednesdays over CBS. Marshall is currently featured in the "Ziegfeld Follies." He made his American professional début seven years ago with the Metropolitan Opera Company. He is a native of Lawrence,

FLOYD GIBBONS
EV. MARSHALL

THELMA GOODWYN
HARRY RICHMAN

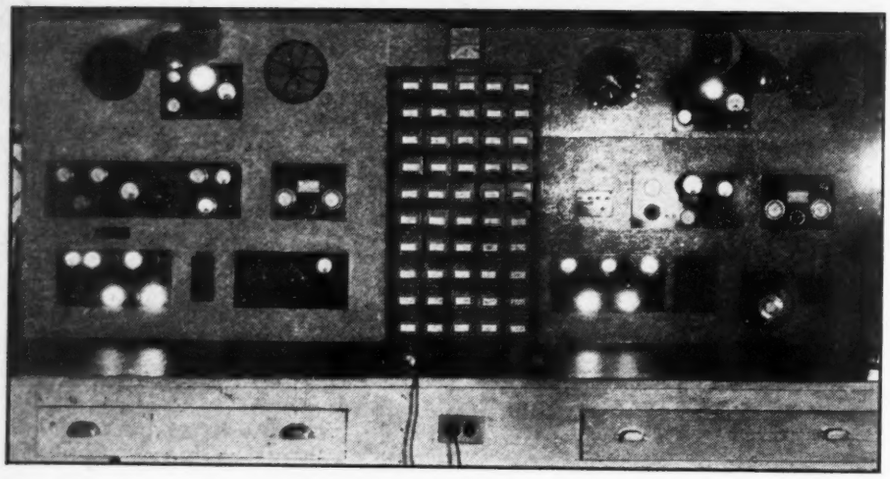
LEE WILEY

Mass., and studied music here and in Europe. He appeared in opera rôles abroad before his Metropolitan début. After four years with New York's leading opera company he entered musical comedy and scored in such productions as George White's "Scandals of 1931" and "Melody." Victor Arden's orchestra supplies the musical background for the Marshall series.

THELMA GOODWYN, the young soprano now featured on CBS Tuesdays, Thursdays and Saturdays, with Rollo Hudson's Orchestra, was selected for the series on account of her unusual radio versatility. On Tuesdays the series features sentimental songs, on Thursdays popular tunes and on Saturdays concert arias. And Thelma was chosen on account of her ability to do all types of compositions equally well. She is a native of New York and made her radio début five years ago. The stage beckoned her and she appeared in many prominent musical comedy rôles.

GLADYS SWARTHOUT, noted mezzo-soprano of the Metropolitan Opera Company, is starred in the Palmolive Beauty Box Theatre operetta series presented Tuesdays over NBC. A permanent stock company for the series features such outstanding radio names as John Barclay, Theodore Webb, Frank McIntyre, Peggy Allenby and Georgia Backus. An augmented studio orchestra is conducted by Nathaniel Shilkret. The programs are a full hour in length. The series immediately soared to a leading position.

JOHN BARCLAY



THE SERVICE BENCH

ZEH BOUCK

THE SALES END OF SERVICING

THE importance of SALES PROMOTION in SERVICING is second only to technical ability, as is evidenced by the volume of relevant contributions which pour into the service desk. The Cunningham Radio Service, of Houston, Texas, capitalizes on what we would call—

A Natural

The rear view of their service car—a Ford V-8 sedan delivery—is shown in Figure 1. As they are dealers for Cunningham tubes, they spell their name in the familiar Cunningham script, achieving a desirable and ethical tie-up. The three telephone numbers of this company are, as will be observed, all sevens—and the license number of the car is similarly 7777! Not that a line-up like this can be duplicated in every instance, but a bit of thought will often indicate a snappy aid to memory. In many states, if application is put in early enough, it is possible to secure an auto license identical with your street or telephone number. All the Cunningham Radio Service has to do now is to move to 77 77th Street.

Another Point of View on House-to-House Canvass

In our February department, W. J. Robertson, of Long Beach, California, described a system of house-to-house canvass and a general service and sales policy. We have received numerous letters criticizing Mr. Robertson's methods—typical of which is the communication aired below. It should be pointed out, however, that Mr. Robertson merely provided details of a sales campaign that worked out well for him. He did not guarantee consistently successful results where conditions may be quite different from those under which he was operating. On the other hand, there must be thousands of servicemen who could augment their present income by following the precedent set by Mr. Robertson. Ralph E. Loomis, of Tillamook, Oregon, takes issue with Mr. Robertson: "In the first place, I possibly have the advantage over Mr. Robertson, in years of experience in the radio game. As for equipment, I have that, and plenty of it, but find that if the brain element were eliminated it would be useless as a piano to a hog. Under Mr. Roosevelt's code of fair competition, I believe that one should only work from an established place of business, namely, a service shop located in the business district. Working from a shop of this kind, I have absolutely *no time to spend scattering literature from door to door.* Wouldn't it be an amusing sight to see an automobile mechanic, a doctor, or a dentist, plying his trade from door to door? What is the difference? A dentist, for instance, could carry a kit of tools for inspection purposes, even enough to do minor extractions, etc., in the home. I consider the radio service business a profession, even as one of the above. Free inspection and tube testing is all right if the machine is brought to the shop. But can a man afford to drive a

FIGURE 2

car from one to seven miles, to satisfy a customer as to whether or not the man who just left made an estimate which is excessive? I say *'no.'* Neither can a man who is in the business continue so, if he makes a maximum service charge of one dollar, unless he is in that business for his health. An elaborate guarantee is right. It inspires the customer's confidence, which is necessary in this day of gyp repair men, door-to-door tube salesmen, and all the rest of the artists who are out for the immediate dollar and not future business. Your credit is good??? Yes, about 85% of the time; but in present times when men are depending on federal projects, etc., for a living, can you and I take the chance? Food and shelter, is man's first thought when capital is low. I have had experience in house-to-house selling (not radios). The customer will 'bite,' I agree, on such offers of service, extensive credit, etc., once; but after that, he has learned his lesson, many times a severe one, and will invariably return to the established house, where he is sure of first-class, highly efficient service. Another side of the guarantee question: A long-time guarantee is made on a repair job on a set of questionable make. Another part of the set breaks down, and the set goes dead. Whose fault is it? Just try and convince a non-technical customer that it is another component of the set and *not* the repair you made. In the past few years more old radios have been repaired than ever before. Why? Not because there are more old radios but because a good repair job is cheaper than a new radio. In these times I am of the opinion that this has much bearing on the case.

"My policy is this: A 75-cent service call; sets checked and repair estimated free if the set is brought to the shop; a charge of one dollar per hour for labor, all parts and tubes at list prices; a liberal guarantee; repair or merchandise, cash or thirty days. Ten percent discount to amateurs and dealers for whom I make repairs. Shop hours from 8 till 6. Calls made at any time, any place. (Mileage charged for special out-of-town calls.)

"The idea is: Spread out, not to the houses, but to kindred branches such as auto-radio, public-address, etc.

"I find that the above policy tends to inspire confidence, create future business and insure satisfaction. If you make a friend of a customer, his friends will become your customers. Satisfaction is what counts This is merely the opinion of one who always has another set to repair. Business is not dead, it is just waiting to be built up. Get the habit of satisfying and you will be satisfied."

And Mr. Robertson, who started all this, comes through with another contribution, this time on—

Unfair Tube Competition

"The advent of cut-rate stores into practically all classes of retailing has had a very definite influence upon other establishments operating in the same fields. Radio has proved to be no exception, and we servicemen are obliged to recognize and fight this new type of competition. In the sale of tubes this price-cutting is most severely felt. The ability of cut-rate stores to buy in tremendous quantities, together with their willingness to sell at a very few cents margin, enables them to sell tubes far below what we consider a fair profit. Although quite a few of the large tube manufacturers do protect the legitimate dealer and serviceman, several of the oldest brands may be bought at cut-throat prices.

"The problem, as I see it, is to justify our asking full retail price for our tubes. Time and time again a customer will ask me how it is I will ask 65 cents for a -26 tube when he can get a similar tube anywhere from 25 to 45 cents. On the face of it, unless we can substantiate our prices, we would seem to be overcharging the customer. After studying the problem and

FIGURE 1

investigating the policies of the cut-rate organizations, I have found that the customers' objections are easily overcome.

"As far as tubes of inferior quality are concerned, even the most skeptical set owner will listen to the logic of not putting a third-rate tube, costing around 35 cents, in a high-grade radio costing, let us say,

seventy-five to a hundred dollars. If he bought the best radio he could afford, is it not reasonable to buy the best possible tubes for that radio? Furthermore, his experience in other lines will make it clear that factory *seconds* and *thirds* certainly cannot be expected to compare with the highest-quality tubes.

"Finally, I give my customers a 6-months guarantee on tubes bought from me. The guarantee does not hold good, of course, in the case of breakage. Occasionally I make good a tube even though burned out. However, the point that goes over big with the customer is that there is practically no guarantee with the cut-rate outfits. (If you think there is, just try it some time!) Incidentally, mention to the customer that the 6-month guarantee is just twice as long as he got on his radio. In passing, I might say that the 6-months guarantee costs me nothing—I buy tubes with a manufacturer's guarantee for that period."

It Pays to Advertise—Consistently—Where It Pays!

The president of the Star Radio Company, Washington, D. C., Mr. N. N. Wal-

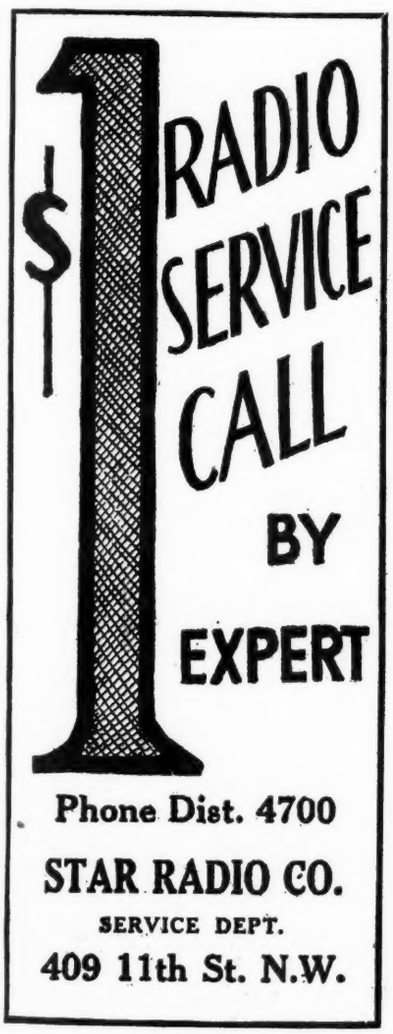


FIGURE 3

lick, is a believer in the psychologically sound dictum that consistent advertising in a small way is more effective than occasional page spreads. A single ad may be forgotten, while a constant reminder, even a modest one, finally makes a permanent impression. The ad shown in Figure 2—a single column by an inch and a half—is published in local papers 365 days out of the year—and is bringing in results that justify the expense. The service call advertised includes minor repairs and the testing of antenna, ground, speaker, chassis, connections, tubes, general analysis and free dial lights. Needless to say, there is little profit in this, but live-wire sales contacts are established, and the majority of calls require tube replacements and repairs for which extra charges are made. On special occasions, the Star Radio Company splurges with the larger ad—single column, five and a half inches—shown in Figure 3.

A Good-Will Card

The illustration of Figure 4 suggests an excellent follow-up idea a few weeks after a service job. The card is actually a

Dear Customer:

Since our reputation depends upon the radio satisfaction of our customers, we take this method to check up on the services rendered during the past few days.

Was everything satisfactory and are you pleased with the service?

Any constructive criticism is welcome. We strive to do everything possible to give you the best radio service and helpful ideas will be appreciated.

CLARK RADIO SERVICE.

FIGURE 4

double folder card, with both sides stamped. When opened, and torn in half, a stamped and addressed card is available for reply.

THIS MONTH'S SERVICE SHOP

Plenty of light, adequate elbow room, system and equipment sum up the story of the Colony Radio Company's service shop, in Washington, D. C., shown in the Heading. The usual oscillators, analyzers, etc., are in evidence, and were designed especially to meet the requirements of expanding business—as the manager-owner Harold Stoll, explains. "Duplicate equipment is mounted on each side of the chest of small parts and filing drawers—with sufficient space for two men to work simultaneously before each panel. Red and green pilot lights are actuated by the various switches and indicate which circuits are in operation. A special switchboard provides for the matching of speakers with any receiver output, provision being made for field supply as well as impedance balancing. Each panel contains one dynamic and one magnetic speaker. In the lower drawers we carry a stock of all makes of transformers, volume controls, resistors, tubular condensers, etc. We are the only service shop in Washington," concludes Mr. Stoll, "with three bona fide engineers under one roof."

SERVICE SHORTS

There are enough service publications being issued by manufacturers to provide the serviceman with a veritable library renewed monthly *** Among the best of these is the *R.C.A. Radio Service News*, and the April 1934 issue is of particular interest as it contains extensive dope on the R.C.A. "World Wide" antenna system *** The *Sylvania News* features organization and straight service dope as well as data on new tubes *** Automatic defrosting and twin-cylinder freezing are the principal selling points in the Sparton refrigerator *** The Kendell system (6 East 46th Street, N. Y. C.) of solving sound problems for small theaters offers unusual opportunities for the serviceman *** *The Victor News Reel* (242 West 55th St., N. Y. C.) disseminates live-wire data on the movie sideline *** Speaking of sidelines, the electric clock is an excellent bet, and Telechron has an interesting display and sales proposition. Write for the *Telechronicle*, their trade sheet, to Ashland, Mass. *** The Sparks-Withington Company is expanding its dealer and dis-

(*Continued on page* 127)

THE TECHNICAL REVIEW

JOSEPH CALCATERRA

Short-wave Wireless Communication, by A. W. Ladner and C. R. Stoner. Second Edition. John Wiley and Sons, 1934. It is always refreshing to find a book on radio that does not begin just like all other books. The usual beginning of text-books on radio is a chapter on the constitution of matter (which becomes rather tiresome if one reads several of them). The authors of this volume begin their text-book with an interesting treatment of electromagnetic waves. The book is written for those who wish to operate or design short-wave apparatus (engineers, operators, amateurs) and presupposes that the reader is somewhat acquainted with radio communication on longer wavelengths. To our knowledge, this is the only *engineering* text-book on short waves in the English language. There are several subjects (generally not understood) which have been treated clearly in this volume. These are the propagation of electromagnetic waves through space, high-frequency transmission lines, antennas, antenna arrays. As we remarked previously, the beginning of the book is concerned with wave propagation. Then follows the problem of modulation and there is a chapter entitled "Push-pull" which shows all the tricks that can be done with push-pull circuits—such as side-band suppression and other special uses. Then there are several chapters on transmitters, oscillators, constant-frequency oscillators., modulation circuits, etc. The chapters on feeders might well be studied *very carefully* by the reader who expects to use them. After a treatment of antennas and arrays, the authors turn their attention to receivers. There are two chapters on receivers and transmitters of the commercial type such as those used on the trans-atlantic service. The final chapter is a discussion of ultra-short waves.

Magnetic Materials at Radio Frequencies, by F. M. Colebrook; published by the Department of Scientific and Industrial Research, London, 1934. This is number fourteen of a series of papers on radio research. The object of the number is to summarize existing knowledge of the characteristics of magnetic cores of the laminated forms and dust forms at radio frequency. A selected bibliography is given.

Sound, Its Fundamentals and Methods of Application, published by Lafayette Radio Manufacturing Co., 1934. This book is directed at the man who makes a specialty of installing public-address systems (or expects to do so). It clarifies all the problems involved from the microphone to the loudspeaker. First, the different sources of sound (microphones, pick-ups and tuners) are considered. The relative merits, characteristics and sensitivity of different apparatus compared and circuits are given, showing how to hook them up. Then we proceed to mixers; again with circuits and data on attenuation networks. The chapter on amplifiers considers the requirements, gain, power output, frequency response, etc., of amplifiers and hints on how to determine the proper type of amplifier for a given application. Speakers of various types, how to connect them and how to place them is discussed in another chapter. Finally, we come to the decibel. The authors have gone to unusual trouble to explain the use of the decibel in a non-technical way, also giving a very useful chart.

Practical Information on Using Resistance Wire. Technical Service Bureau of Chicago, 1934. This technical bulletin contains several tables of the properties of resistance wire, such as nichrome, chromel and trophet, and gives instructions on how to use them. The bulletin easily can be followed by readers without specialized technical training. It considers such problems as how to determine the length and size of wire to use for different electrical appliances when the heater unit has broken down. Information is given also for the use of resistance wires for rheostats.

Transmitter and Power Amplifier Guide. Published by Thordarson Mfg. Co. This booklet, besides being a catalog of transformers, gives a wealth of data on transmitters and power amplifiers and contains numerous circuits.

Review of Articles in the May, 1934, Issue of the Proceedings of the Institute of Radio Engineers

High-Quality Radio Broadcast Transmission and Reception, by Stuart Ballantine. This paper covers in considerable detail the factors which must be taken into consideration in the design and construction of radio transmitting and receiving equipment to obtain satisfactory high-quality reception of radio programs.

The Retarding-Field Tube as a Detector, by H. E. Hollmann. This paper gives a detailed description and explanation of the demodulation effect of the retarding-field detector, and describes a new type of rectifier arrangement that also can be used advantageously with any wavelength.

Stray Capacitance on the Accuracy of Antenna Resistance Measurements, by Edmond A. Laport. This paper shows that stray capacitance at the base of a capacitive antenna decreases the apparent antenna resistance while in the case of an inductive antenna it increases it. A method of approaching the true resistance of an antenna in the presence of stray capacitance is presented.

A Chopper Utilizing Contacts Vibrating in a Vacuum, by F. G. Kelly. This paper describes the theory, construction and use of a chopper, approximately the size of a radio receiving tube, for small voltages and currents.

Review of Contemporary Literature

New Airport Receivers, by H. B. Fischer. Bell Laboratories Record, May, 1934. The Type 11 aircraft receiver described in this paper is the result of considerable development work to perfect a highly selective receiver for aircraft work, capable of giving interference-free reception in the over-crowded band allotted for such service.

New Weather and Beacon Radio Receiver, by W. E. Reichle. Bell Laboratories Record, May, 1934. The Bell Laboratories Type 14A airplane receiver, designed especially for high selectivity to permit reception of signals from low-power runway localizing beacons while in the vicinity of strong airway beacons or weather stations, is described in this article.

Remote Controls for Aircraft Receivers, by B. O. Browne. Bell Laboratories Record, May, 1934. This paper describes a new type of remote control, the Bell Laboratories 700A Selector, designed especially to meet the requirements of airplanes for a compact, lightweight and easily operated method of changing receiver tuning adjustments to predetermined positions by the use of push-buttons or position switches.

Articulation Testing, by W. A. Munson. Bell Laboratories Record, May, 1934. This article describes the procedure and apparatus used in making articulation tests to determine how well a telephone or amplifier system reproduces each of the many separate sounds of which speech is composed.

Broadcasting Network Service, by Long Lines Department, American Telephone and Telegraph Co. This booklet gives a historical review of the development of the telephone networks service and a description of the facilities, plant structure, investment, cost of operation and procedure used in providing a networks program through the connection of a number of stations through telephone lines.

New Reactance Meter, by H. H. Scott. General Radio Experimenter, April, 1934. This article describes the principle of operation and use of the reactance meter, made by the General Radio Co. under Hazeltine patents, in making quick measurements of coils and condensers.

New Shielded Transformer for Bridge-Circuit Use, by Robert F. Field. General Radio Experimenter, April, 1934. This article gives a description of the principles used in the design of the General Radio Type 578-A bridge transformer, developed especially for use in bridge circuits.

Applications of Pitch and Intensity Measurements of Connected Speech, by Joseph Tiffin. The Journal of the Acoustical Society of America, April, 1934. The effect of pitch and intensity variations in speech and their effect on listeners is discussed in this article.

Phonetic Distribution in Formal American Pronunciation, by Charles H. Voelker. Journal of the Acoustical Society of America, April, 1934. This article presents the results of a study of relative occurrence of speech sounds in English as a basis of operation in the study and design of communication equipment, speech improvement and perfection of shorthand systems.

Studies of the Ionosphere and Their Application to Radio Transmission, by S. S. Kirby, L. V. Berkner and D. M. Stuart. Bureau of Standards Research Paper RP632. This pamphlet covers observations of the virtual height of the ionosphere and

its variations carried out by the Bureau of Standards during the period of September, 1930, to April, 1933, with discusions on the observations.

Group Listening. This report on group listening was prepared by the British Institute of Adult Education for the National Advisory Council on Radio in Education, Inc. It traces the development of the group listeners, brings out the factors which tend to help or hinder the success of programs designed for group listening and gives helpful information to those interested in organizing such programs.

Recording and Reproducing Sound, by H. A. Frederick. The Review of Scientific Instruments, May, 1934. This paper traces the development of the three important methods of recording and reproducing sound, explaining the theory of operation of the various methods and points out the advantages and disadvantages of each type.

Crystal Control of Transmitters, by R. Bechmann. The Wireless Engineer and Experimental Wireless, May, 1934. This article contains a description of the crystal-control circuits and equipment used at the Telefunken high-power transmitter at Bisamberg (Vienna).

Precision Heterodyne Oscillators, by W. H. F. Griffiths. The Wireless Engineer and Experimental Wireless, May, 1934. A discussion of several essential design features of the heterodyne type of audio-oscillator —more particularly those affecting calibration permanence and frequency drift—is contained in this article.

Broadcast Transmission Progress at CBS, by A. B. Chamberlain. Electronics, May, 1934. The many improvements made in the transmission system of the Columbia Broadcasting System during the past year are described in this article.

How to Get Copies of Articles Abstracted in This Department

The abstracts of articles featured in this department are intended to serve as a guide to the most interesting and instructive material appearing in contemporary magazines and reports. These publications may be consulted at most of the larger public libraries or copies may be ordered direct from the publishers of the magazines mention. RADIO NEWS cannot undertake to supply copies of these articles. They are *not* included in the RADIO NEWS Free Technical Booklet Service.

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Review of Technical Booklets Available

2. *1934 R.F. Parts Catalog.* Specifications on the entire line of Hammarlund variable and adjustable condensers, r.f. transformers, sockets, shields and miscellaneous parts for broadcast and short-wave receivers, complete short-wave receivers and transmitting variable condensers.

4. *A 15- to 200-Meter Superheterodyne.* A description of the outstanding features of the Hammarlund-Roberts high-frequency superheterodyne designed especially for commercial operators for laboratory, newspapers, police, airport and steamship use.

5. *A 1934 Volume Control and Resistor Catalog.* Data on standard and replacement volume controls, Truvolt adjustable resistors, vitreous wire-wound fixed resistors, voltage dividers, precision wire-wound non-inductive resistors, high-quality attenuators, center-tapped filament resistors, power (0-watt) rheostats and other Electrad resistor specialties.

6. *Line Voltage Control.* Characteristics and uses of a voltage regulator and chart showing the correct Amperite recommended by set manufacturers for their receivers.

7. *Rich Rewards in Radio.* Information on the growth of radio and the opportunities existing in the field of radio manufacturing, radio servicing, broadcasting, talking pictures, television, public-address systems and commercial station operation on land and sea, for men who are trained to fill the many jobs created by the radio and allied industries.

9. *Resistor Catalog.* Specifications of the International Resistance Co. 1934 line of metallized and wire-wound resistors, motor-radio suppressors, handy servicemen's kits, valuable technical data and list of free bulletins available on the building of servicemen's test equipment.

25. *Noise-Reducing Antenna Systems.* Two types of noise-reducing systems perfected by the Lynch Mfg. Co. for both broadcast and short-wave reception.

26. *Auto-Radio Antennas, Filters and Suppressors.* Describing a line of Lynch antennas, filters and ignition noise suppressors especially designed for motor-radio installations.

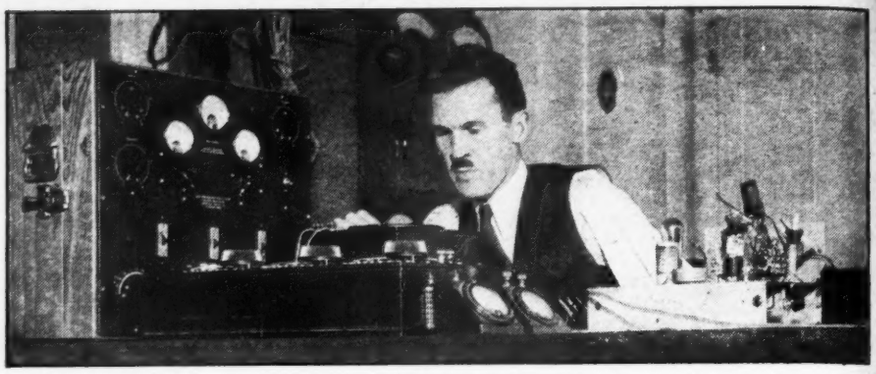
34. *Serviceman's 1934 Replacement Volume Control Guide.* A list, in alphabetical order, of all old and new receivers showing model number, value of control in ohms and a recommended Electrad control for replacement purposes. Specifications and volume control circuits for over 2000 receiver models.

41. *How to Build the "Economy Eight."* Wholesale Radio Service Co. folder giving constructional information, diagrams, list of parts, etc., of an efficient 8-tube receiver.

44. *A Remote Control and Station Selector Unit for Any Receiver.* How any single tuning control receiver can be converted into a remote control and station selector set at a total cost of only $12.50.

51. *A Low-Cost 5-Tube Portable A.C.-D.C. Receiver.* Details of a kit of parts designed to meet the need for an exceptionally efficient but low-cost universal portable receiver which can be built by servicemen and experimenters in their spare time and sold at a profit.

(*Continued on page* 124)

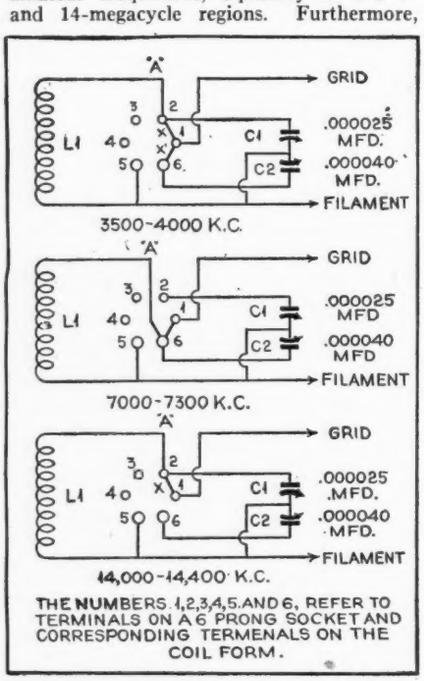


WITH THE EXPERIMENTERS

S. GORDON TAYLOR

A Novel Idea for Band-Spread Coils

Band-spreading is a necessary requirement for present-day "ham" receivers; in fact, operation on the 20-, 40- and 80-meter bands is practically impossible without it. Yet most of the band-spread receivers that I have operated fell short of the mark on one point—that is, the impossibility of preserving any accurate calibration of the dials. The band-spread circuit described and illustrated here not only makes accurate calibration easy, but actually gives a much better spread of the amateur frequencies, especially in the 7- and 14-megacycle regions. Furthermore,



with this method the set can be used for continuous-frequency operation on the communications wavelengths and still retain its band-spreading properties on the amateur bands.

As shown in the diagram, the band-spread circuit consists of a set of ordinary short-wave coils wound on six-prong forms, a six-prong tube socket and a two-section tuning condenser. The coil forms and the socket should be of isolantite or a similar low-loss material; the tuning condenser may be a two-gang midget or two small condensers coupled together.

The heart of the circuit lies in the unusual wiring arrangement inside the coil forms and from the coil socket to other parts of the circuit for the different bands covered.

The operation of the circuit is as follows: When the 3500-4000 k.c. coil is placed in the socket the tuning condensers C1 and C2 are connected in parallel, thereby spreading this band over approximately 76 degrees on the dial. Now if the 7000-7300 kilocycle coil is plugged in, coil terminal "a" is automatically disconnected from point 2 and is connected to point 6. Since the wire X is also removed, the condenser C1 is disconnected, leaving only condenser C2 across the coil. The maximum capacity of C2 is approximately 40 mmfd. which causes the 300 kilocycles of this band to be spread over 54 degrees of the dial. The 14000-14400 kc. coil operates in a manner similar to the 7000-7300 kc. circuit except that the condenser C2 is removed from the circuit, leaving only C1 across the coil. This section has a maximum capacity of about 25 mmfd., causing the 400 kilocycles of this band to occupy approximately 50 points on the dial.

If continuous tuning is desired, in addition to the band-spread feature, the continuous-frequency coil connections are made as shown in Figure 1 for 3500-4000 kilocycles operation.

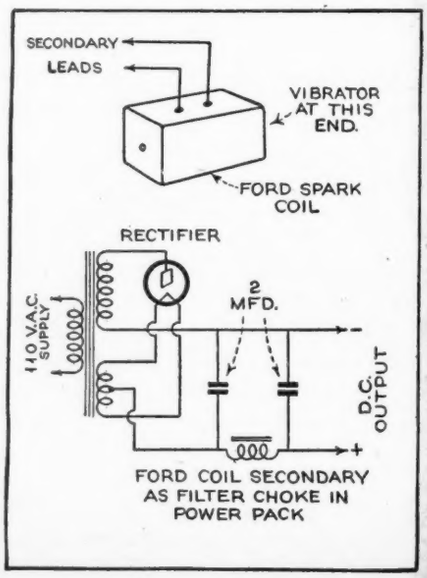
The data for the band-spread coils are as follows:

3500-4000 kc.—24 turns No. 24 d.c.c. wire, close wound, form 1½ inch diameter; 7000-7300 kc.—12 turns No. 22 d.c.c. wire, close wound, form 1½ inch diameter; 14000-14400 kc.—7 turns No. 22 d.c.c. wire, spaced one diameter, form 1 inch diameter.

H. D. HOOTON,
Beech Hill, W. Va.

Spark Coil as Filter Choke

The secondary winding of a Ford spark coil makes a satisfactory substitute choke



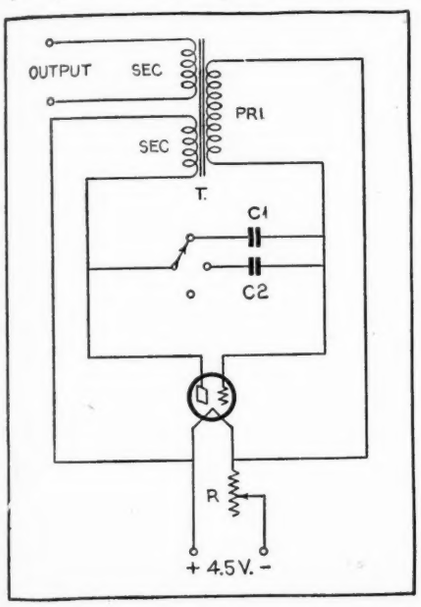
coil for use in a home-made plate supply unit. The two connections shown in the drawing are the secondary terminals on most Ford spark coils. If large condensers are used in the filter section the a.c. hum will be completely eliminated. The rectified voltage may have to be raised to compensate for the voltage drop caused by this substitute choke coil winding. If a smaller choke coil is desired, one-half of the secondary may be used simply by tapping it where the two windings are joined.

GEORGE MARK,
Los Angeles, Calif.

A Compact Audio Oscillator

Experimenters and servicemen will be interested in this portable light-weight audio oscillator. The instrument is simple to construct and it has numerous possibilities for test work.

The transformer I use is a small, cheap push-pull unit with a split secondary wind-



ing, as shown. One of the secondary windings is connected to a pair of binding posts and is used as the output coupling coil. The remaining two windings act as grid and plate coils. If the unit fails to oscillate, reverse the connections to the primary winding. A type –99 tube was employed simply because I had no other low-voltage tube on hand. A type –30 tube will serve equally well and requires only a 3-volt battery.

The basic tone with this particular transformer was high-pitched. Tone control is taken care of by fixed condensers across the plate and grid, as shown at C1 and C2 in the diagram. A .006 mfd. condenser for low tone and a .0005 mfd. condenser for medium tone are the values used with this particular transformer. The entire unit is housed in a small box, measuring 7½ inches long by 6½ inches wide by 3¾ inches high.

Incidentally, boxes of this size can be had for the asking. Go to your neighborhood cigar store and ask for a cigar box of the type equipped with brass hinges and a catch. Scrape the name off the top and sides, then sandpaper and give it a coat of flat black paint followed by a coat of black enamel.

Parts List

One –99 tube
One tube socket
One 30-ohm rheostat
One 3-point switch
One .006 fixed condenser
One .0005 fixed condenser
Two binding posts

(*Continued on page* 128)

RADIO PHYSICS COURSE

ALFRED A. GHIRARDI*

Lesson 32

Variable Inductors

INDUCTORS are often made so that their inductance can be varied by one means or another. The variation can be obtained by means of a slider as in (A) of Figure 1; by means of taps and a switch as at (B); or by arranging the coil in two parts so that one can be rotated near the other as at (C), or within the other as at (D). They can also be arranged to move nearer or further away from each other as at (E); or the inductance can be varied by bringing a metal plate within the field of the coil as at (F). The eddy currents induced in the plate produce a field which opposes the field of the coil, thus reducing its inductance. This latter method is not recommended, as it usually results in a rather large loss of energy. Small changes in inductance can be obtained by spreading apart a few of the turns near the ends of a coil as shown at (G). This increases the leakage flux and so reduces the inductance slightly. This method is often used for producing very slight changes in tuning-coil inductance when "ganging up" a series of tuned circuits in a single-control radio receiver.

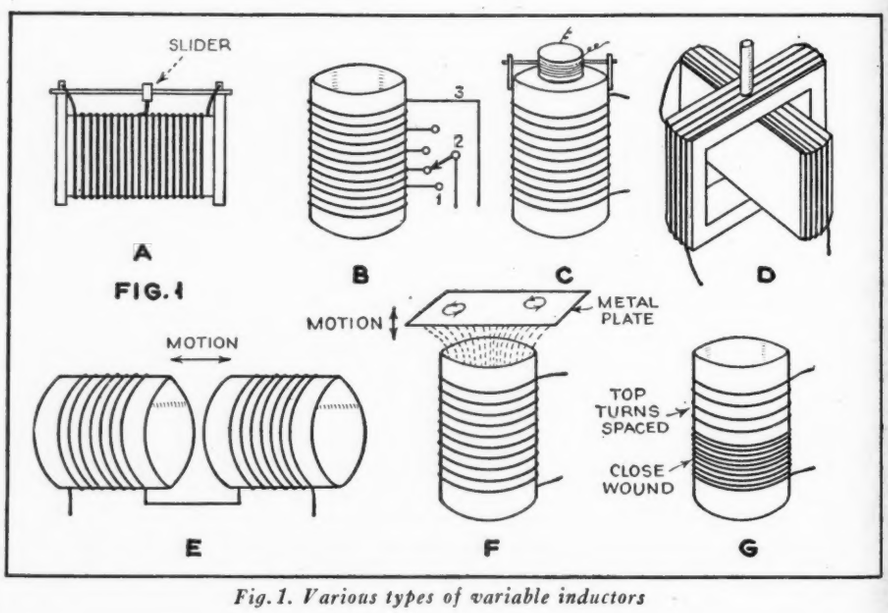


Fig. 1. Various types of variable inductors

The arrangement shown at (D) is commonly known as a variometer. The inductance is continuously variable from a low value when the coils are connected in series opposing to buck each other, to the maximum value when they are rotated so their fields aid, or are connected series aiding. One small commercial variometer used for radio laboratory work has an inductance variation from .1 to 1 millihenries when its two coils are connected in parallel and from .3 to 4.2 millihenries when its coils are connected in series with each other. Sometimes the two windings are not connected to each other. This forms a *split variometer*.

Somewhat the same result is obtained with the rotating coil arrangement at (C). In the case of the tapped coil at (B), the *dead-end* or unused portion of the winding 1-2 has a voltage induced in it, and this voltage causes a current to flow through the distributed capacity of the coil. This acts on the used part 2-3 of the coil in such a way as to increase its resistance or opposition to current flow. If dead-ends must be used on a coil, it is best to completely disconnect them from the remainder of the coil when they are not in use. This will reduce the loss considerably.

Review Questions

1. An inductor of 200 microhenries inductance is connected in "series-aiding" with one of 400 microhenries and placed so that mutual indication can take place. The coefficient of coupling K is .5. Calculate the mutual inductance, draw a diagram showing the condition.

2. What is the total inductance of the circuit in Question 1?

3. What would be the total inductance if the coils were connected "series opposing"?

4. In a screen-grid radio-frequency interstage-coupling transformer, the primary inductance is 300 microhenries and that of the secondary is 200 microhenries. The mutual inductance due to their positions is 160 microhenries. What is the coefficient of coupling?

5. Draw the primary and secondary coils of an air-core transformer. Explain why the co-efficient of coupling is decreased as the primary is moved farther away from the secondary. What is the maximum value the coefficient can have? Draw the positions of the coils for this condition.

6. Explain three ways for constructing an inductor whose inductance value can be varied easily.

7. A variometer has the following constants: Stator turns 1174. Rotor turns 1174. Total inductance with the two coils in "series-aiding" 626.5 millihenries. Total inductance with the two coils in "series-opposing" 106.5 millihenries. What is the ratio of maximum-to-minimum inductance of this variometer? What is the mutual inductance?

* Radio Technical Pub. Co. Publishers, Radio Physics Course.

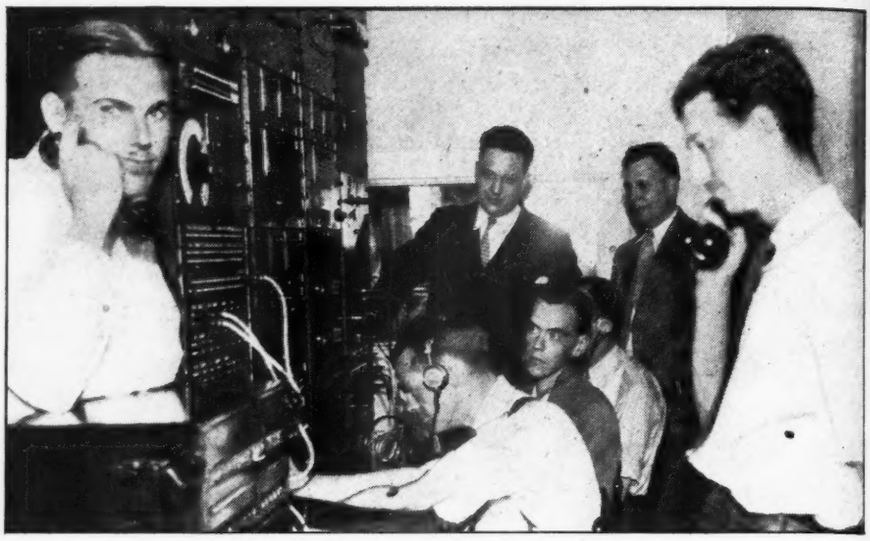
Why Not Facsimile?

(*Continued from page .77*)

number of times. The illustration in Figure 1 shows the operator transmitting from paper text by the direct method unit. At the right, however, is the film unit for continuous film transmission. Either one can be used, as the two input devices are so arranged they may be used interchangeably and their performance is so nearly the same.

During the demonstration in New York three receiving machines printed the facsimile program from the laboratory, transmitted by radio, at a distance of about five miles. The first item to be received was a strip of comic characters from the newspaper; the second item was a bridge problem in which the distribution of the hands was written out in type; the third item consisted of a children's paint book prepared by Mr. Ernest Duffy, the artist. It contained simple outline drawings which could be colored by children and then folded into a little book. The next item used coordinated channels, with a standard musical-composition sound channel and a supporting facsimile channel carrying a text of stories about the music being transmitted. Then followed a children's story showing pictures of Cock Robin on the printer channel, while the verses came over the sound channel. The final program item was a running description of an automobile trip, from New York to West Point and return, using highways on both sides of the Hudson River. The sound commentary was accompanied by a facsimile map which was drawn as the trip proceeded so that the imaginary home user would have a verbal and written description of the journey, showing the roads to follow and the town and other points of interest he would encounter on such a trip. A few sample strips of the received visual program were cut from the machine and are reproduced herewith.

The inventors point out that this demonstration is to be considered in no sense a commercializiation that has been fully perfected and is ready for sales and program exploitation. They do believe, however, that they have made a number of definite and important steps towards the provision of a radio picture and printer service for home users and one that may grow to parallel normal speech and music broadcasting services now in wide use. When asked whether such a service could be accepted as a competitor to regular broadcast sound channels or to the newspapers, Mr. Hogan replied that both television and facsimile transmission for the home would best be developed as supplements to sound broadcasting as a cooperative activity rather than as a type of competition. He did point out, however, that a facsimile system such as this would produce and leave with the home user a written ink-on-paper souvenir of the program to which he had been listening. He pointed out that the speed of transmission, at the present stage of development, for the Radio-Pen was from 30 to 60 words per minute, depending on the type size and style used. He stated, "Since its message speed in words per minute is less than half that which may be attained in speaking and since it would require over three hours to transmit the text contained on a single newspaper page, or more than a day to copy even a small newspaper, I personally see no reason to consider that the Radio-Pen will in any way tend to supplant our present news-distributing organizations. Instead, I believe that there are many ways in which the facsimile radio system, the newspaper and the sound-radio can and will cooperate to their mutual advantage."



QRD? QRD? QRD?

CONDUCTED BY GY

AS mentioned in Dots and Dashes last month, RCA has recently opened its new inter-city radiotelegraph service linking Boston, New York, Washington and 'Frisco with a few more cities in contemplation of erection. This service will be an immediate success due to the low rates and the speed of transmission. In cooperation with Western Union, whose offices will be used for pickup and delivery, this method of ultra-short-wave high-speed transmission will be an added factor in the hiring of more men in various capacities, especially those having a knowledge of teletype operation. Viva RCA!

We see by the papers these short-wave boys can dig themselves out of any hole just by the use of their old xmtrs. Burt Taylor sent out a successful SOS (Save Our Sedan) when his auto got stuck in a mud-hole near Haverhill, Mass. He had installed in his car, a short time before, an elaborate portable two-way transceiver job and with this he flashed his predicament to 1HC (Hampton, N. H.) who telephoned to a garage near the spot of Taylor's catastrophe, which immediately sent out a tow car to fetch him in. What would we do without these amateurs in times of distress, eh?

At last the ARTA has moved into quarters commensurate with its present membership strength. The new address is 22 Whitehall Street, New York. Eventually, it is hoped to expand the premises so that forms of recreation will be installed for those men awaiting calls for assignments to ships or stations.

It will probably please the proletariat to learn our old friend, Harry Chetham (HC) chief of Police Station Radio Station "WPEH" has at last been confirmed by the entire Civil Service Board of Massachusetts. After almost 33 months of continuous battling, Harry has at last won out and made his job secure. He has done yeoman work organizing and building up a fine personnel and system for the department of Somerville, Mass., and his just desserts have been meted out to him. Because of a slight physical defect, he was to be disqualified for the position, but the Board realized that his ability as a radioman and an organizer of men was more to be considered than this defect. Is it tenacity of purpose or persistence or native ability which makes a man win out after months of discouragement?

The Bulletin of the ARTA recently carried an editorial which had for its theme "Cooperation and unity within the ranks." The meat of its total length contained such phrases as "Clean up our own house before we attempt to clean someone else's." "Don't wait for the other fellow to become a member, but be one yourself and the others will follow." These exhortations have been presented in this column from time to time, but still there are those ops who continue to wait for the ARTA to become so strong as to be able to get these persons better working conditions without their individual cooperation and support. It must be understood that any organization cannot go before a board of arbitration without *showing a sufficient strength in membership* to receive consideration of its demands. Think this over, me hearties. The ARTA continues to show marked improvement in the rising membership and has issued a statement which shows that progress has been made in bettering working conditions and raising salaries of operators. There are also reports of code violators which will be taken up by the organization, with the proper authorities in Washington. The San Francisco Local sends greetings, with a report of a 100 percent membership in its area and has been able to obtain overtime for Mackay Radio PTP men, retroactive back to September, 1933 . . . obtained an agreement with the McCormick SS Co. of San Francisco to employ eleven permanent men instead of the seven who have had to jump from one ship to another as they hit port. All in all, good work has been done. It is to be hoped that enthusiasm will continue to show further bettering of conditions for all operators, whether they are in broadcast, marine or air service.

It seems that most of the boys are holding down their billets as reports show that not many are waiting in the Buzzer Rooms. Assignments have been made in greater numbers than heretofore because of shipping activity now that perfect weather is here and exports continue to grow. Enyho, things are continuing to *look up* and legislation, plus the New Deal, will be able to bring around those conditions when an operator will have some self respect and will be one to respect.

The chap with the mail bag has been kind to us this month, having left all the unpaid bills outside the door and brought in plenty of mail with resquests for the usual infor-

mation as to where a brand-new op can get placed to get himself a summer cruise, etc. Then there are those like KGFL, who has had some difficulty with the boss on another salary cut, which can be easily straightened out by communicating with the broadcast code administrator in Washington and a review made of the cases in question. . . . G. L. Christianson of Wisconsin should know that *renewal of license is of paramount importance*, as the Great Lakes are open now and possibilities for jobs are greater than ever. . . . Freddy Peterson writes in from Frisco to tell us he has joined the ARTA there and we say "good boy" to that. . . . From K. E. Goodwin, Heeia, Oahu, T. H., we hear that he craves to put his name on the roster of the ARTA, so again we say *he* is on the right track. . . . And Roy K. Bryan of Austin, Minn., sez that he has had some difficulty in getting placed, although with about fourteen degrees tacked onto his name. Perhaps you are in the *wrong spot* or perhaps competition is too keen. Why not write a few letters to the big outfits and see if you don't get something. This country is lots bigger than Austin, Minn. See, Roy? And now, for lack of room, we'll continue the rest in the next issue, so a bon cheerio and 73 . . . ge . . . GY.

Short Waves

(*Continued from page* 97)

The parallel leads are placed close together so that they receive impulses of identical strength. If one wire were to pick-up a stronger impulse than the other, it would force itself through the primary, against the bucking action of the weaker impulse picked up by the other wire, and noise would be heard. The leads must not be placed too close together, or the capacity will be increased to the extent where losses will occur, as mentioned in the case of long wave noise reduction systems used for high frequency work. The leads are usually spaced about three inches.

It is a general practice to transpose the transmission line every two to three feet—that is cross it, as shown in Figure 2—by means of transposition blocks. A typical transposition block hook-up is shown in Figure 3. This provides the most convenient mechanical method of keeping the lead-ins perfectly spaced, and in some instances may contribute slightly to noise reduction. For example, if the transmission line is run close to another wire which may be a conductor of noise impulses, an appreciable variation in field strength may exist across the three inch space between the transmission wires. This means that one wire will receive a stronger impulse than the other, and noise will be heard. But if the leads are transposed, each wire will receive the stronger impulse at different points on the way down, thus re-establishing the necessary balance.

Transposition—or parallel feeding—should be carried out as close to the short-wave receiver as possible. Where the transmission leads enter the house, lightning arresters may be installed—one in each lead. If it is inconvenient to continue the transposition within the house, the leads may be twisted for a short distance. The shorter the better—and certainly not more than ten feet.

As there is no ground used with the transmission line, and most receivers are designed to operate with a ground, coupling to the set sometimes presents a problem. Figure 4 shows the conventional antenna primary circuit—the input circuit to the short-wave set—used often with the ground connected and the transmission lines run to the antenna and ground posts. *It won't work.* What happens is, one half of the doublet functions as an ordinary antenna, and one transmission lead as an ordinary lead-in. The other half of the doublet is useless—it being nothing more than a grounded aerial.

The solution to the problem is shown in Figure 5. Here the ground has been isolated from the transmission line circuit, but remains connected to the rest of the receiver. In the better short-wave sets, provision is made for the correct connection to a transmission line lead-in. Some receiver manufacturers supply noise-reduction antenna kits with their products with full directions for installation, which, needless to say, should be followed carefully, before experimenting with the systems described in this article. (In the majority of instances, however, the recommended antenna will be the doublet with transposed lead-in.)

There are on the market coupling devices which permit the transmission line to be employed with receivers not originally designed for the purpose, without making any change in the set itself, and permitting the ground to the connected to the usual ground post (Figure 6).

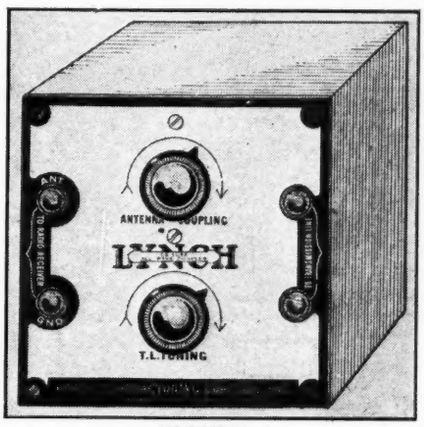


FIGURE 6

The doublet antenna receives best signals arriving at right angles to the direction in which it is stretched. For example, if it is desired to favor stations to the east and west, the antenna should be strung north and south. However, the directional possibilities are not of sufficient importance to take precedence over the more important consideration of erecting the antenna *free and clear of obstructions and as remote as possible from a local noise area.*

Two arms of the doublet are run in a straight line—being broken only in the center by the insulator. The efficiency of such an aerial, on a given wavelength, bears a direct relationship to its length. Preference will be shown to signals, the wavelength of which is twice the total length of the horizontal portion. Also, due to the harmonic relationship, signals the wavelength of which is equal to the length of the doublet will be similarly peaked. For instance, if particularly good reception is desired on the 50 meter stations, the antenna should be 25 meters—82 feet—long. This aerial will also give "pepped up" signals on 25 meters. Excellent (normal) reception will be had between peaks.

There is no necessity for sticking to the straight doublet design when using the transmission line lead-in. Several convenient variations are shown in Figure 7. Of course, as departure is made from the doublet type, an antenna and counter-poise combination is approached, and the directional and peaked characteristics of the doublet are lost. *James Millen,* The National Co.

REMOTE CONTROL

(Motorola Model S-10)

REAL RADIO COMFORT

At the dining table complete control of the radio is always within arms' reach, the portable tuner, A, with its single cable being moved from place to place as desired, while the power cabinet, B, is out of the way against the wall

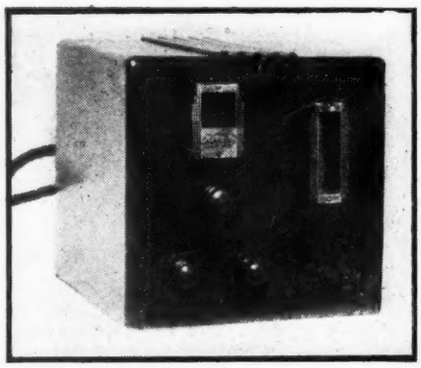
IT is often extremely difficult to forecast trends in radio receiver design. When the compact receiver was introduced to the public a couple of years ago it is doubtful that even the manufacturers anticipated the way in which it swept the country like wildfire. Indications now are that the craze is decidedly on the wane and larger receivers are once more assuming their rightful place in the eyes of the public.

The compact receivers did one thing, however. They brought attention to the advantages of being able to place the radio set in any convenient position where it could be reached and tuned with the minimum of effort, instead of having to locate it in the position, however inaccessible it might be, where it fitted in best with the other furnishings of the living room. It therefore seems safe to prophesy that receivers of the remote control type will develop a high degree of popularity because with such an installation as pictured here the small tuning unit can be moved about from place to place, within the 20 foot radius provided by the cable, and thus always be kept within arms reach. Practically all of the convenience of the compact receiver is therefore retained yet one still has the other advantages of the console type receiver, particularly that of superior quality of reproduction.

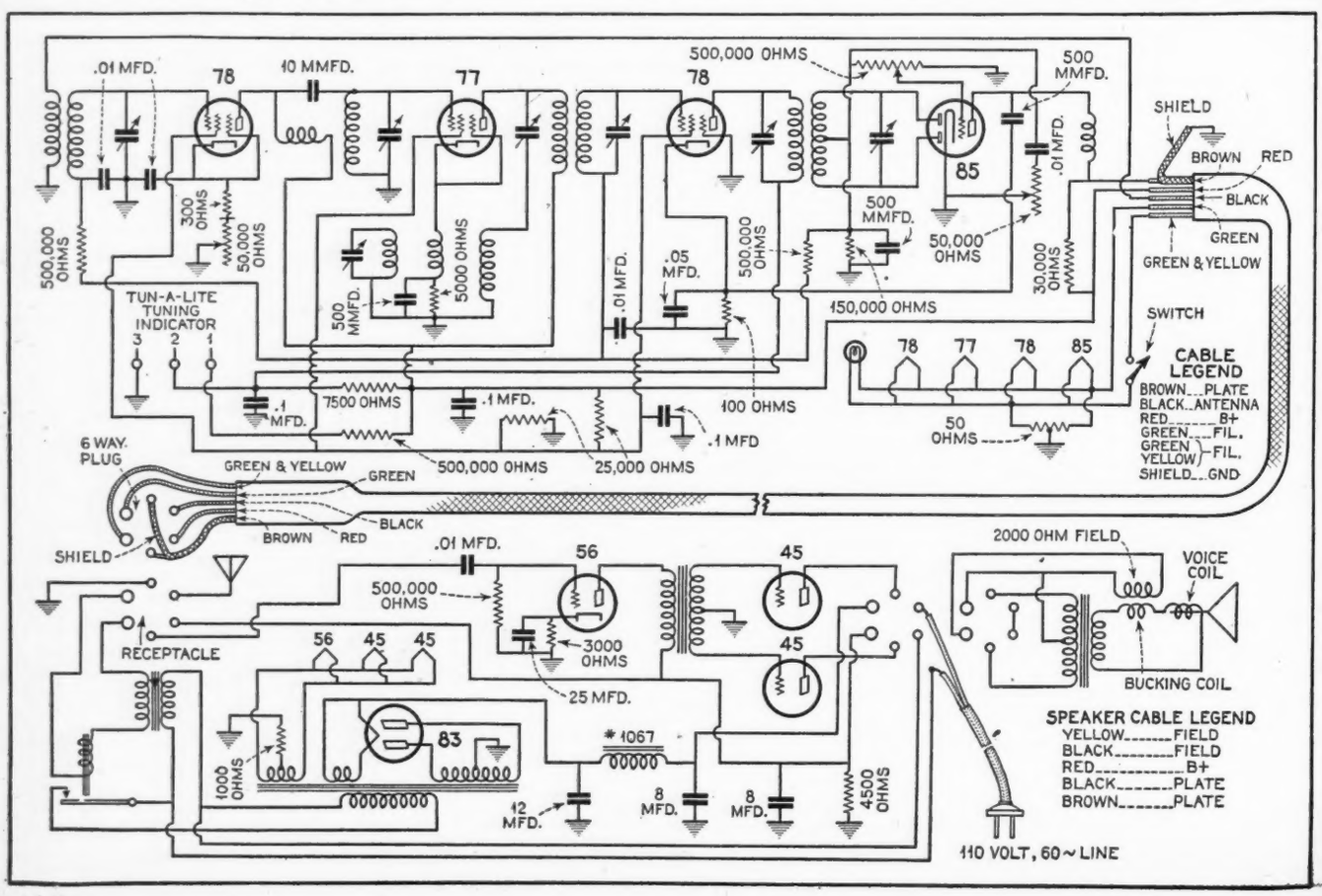
The Motorola "Lazy Boy" Model S-10 receiver illustrated consists of two units. The remote control unit includes four tubes which function as one stage of r.f. amplification; combination detector and oscillator; one stage of i.f. amplification; and a combination second detector, a.v.c and first audio stage. The other unit houses the dynamic loudspeaker; another audio amplifier stage; the power stage employing 2 type 45 tubes in push-pull; and the complete power supply for the entire set.

The only wires coming from the remote control unit are combined in a single cable which (*Continued on next page*)

THE PORTABLE TUNER



THE CIRCUIT DIAGRAM



plugs into the loudspeaker unit. There is no 110 volt a.c. required in this unit and the antenna connection is made to the loudspeaker unit and from there is carried to the tuning unit through the cable. Thus it is seen that the tuner can be moved around at will without any thought to any connection wires other than the main cable.

The tuner, while it is only 6 inches square by 8 inches deep, provides complete control of the entire set. The "on-off" switch contained therein is in series with the tube filaments. The transformer which supplies the filament current is connected to the 110 volt line at all times, thus supplying the power to operate a relay which is connected in the secondary of this transformer. When the switch is turned off this secondary circuit is opened, releasing the relay which automatically turns off the supply to the primary of the main transformer. The fact that the filament transformer primary is connected to the line all the time is of no importance inasmuch as the current drain when the secondary is open is of negligible proportions.

Tone control, volume control, and tuning are accomplished by means of the three knobs shown. The dial is illuminated and is calibrated in frequencies. At the right behind the rectangular window is the "Tunalite" resonance indicator lamp which provides an extremely satisfactory means for showing when the receiver is tuned to exact resonance with the desired station. In addition to all these features, full automatic volume control is included. Thus the receiver features all modern refinements which one looks for in a quality receiver and is in no way to be confused with a "compact" receiver using an oversized loudspeaker.

For those who are technically inclined all details of the circuit are shown herewith.

In tests made at one of the RADIO NEWS Listening Posts the sensitivity, selectivity, a.v.c. action and tone quality were all found highly satisfactory.

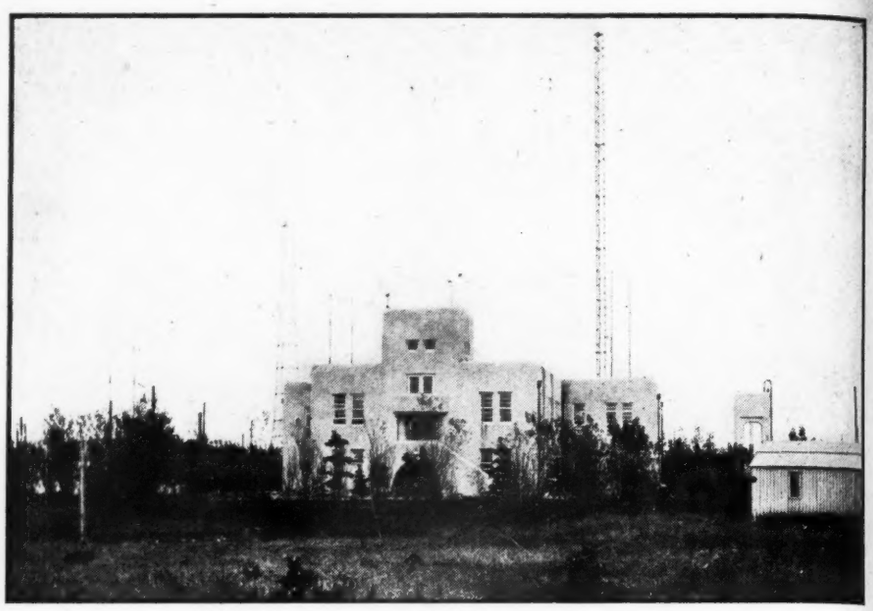
R.F. Amplifiers

(*Continued from page* 84)

reasonable to operate the power amplifier on the same frequency as the last doubler —that is, as a straight amplifier—so that a higher efficiency (perhaps 75 or 80%) will be secured and more power will be fed to the antenna. *It is really only this final stage that does any good towards putting out signals,* the other stages being just necessary evils—so to speak—so that the addition of the extra doubler stage is usually an economical step. However, there are cases where the added complication is unreasonable. As an example, the writer had a transmitter in 1926 (it was one of the earliest amateur crystal-controlled outfits) which consists of a 210 oscillator feeding a 50-watt power amplifier. Straight amplification was used on 80 meters. The 50-watter became a doubler when it was desired to operate on 40—and it became a quadrupler when some 20-meter energy (it wasn't much) was to be sent out! Since, as the wavelength is decreased, power differences become less noticeable (it seemed so at that time, anyway) and since 20-meter operation was then seldom used, the transmitter performed satisfactorily, even on the 4th harmonic. That was in the old days, however, and such an arrangement would now be quite silly—as far as the 4th harmonic is concerned at any rate. As another case, suppose a modern transmitter with a few doubler stages that normally works on the 3.5, 7 and 14 mc. bands is to be used for some 10-meter tests. It would be a lot of trouble to "sandwich in" another doubler stage and get a decent 10-meter output from it, whereas it would probably be quite simple to put a 10-meter coil in the P.A. stage and let it work as a doubler. While there might be a difference as great as 2 to 1 in the outputs (there probably wouldn't on this frequency), there would probably be little, if any, noticeable difference in signal strength at the receiving station.

Our discussion of multipliers seems to have been mostly of doublers. In amateur work with the present frequency allocations it is seldom that a tripler need be used. Ten meters might be reached in one jump from a 30-meter crystal, although the latter would have to be handled very carefully; or a 75-meter crystal that had been ground a little too much might be used for 21-meter operation by grinding it to 63. The same rules that apply to doublers also hold for triplers, with one exception—push-pull combinations. The subject of push-pull frequency multipliers might just as well be brought up now as later—so we proceed.

If we should want to get more power out of a multiplier stage, it would not be the best thing to add another tube in parallel, for two reasons. First, the input and output capacity would be doubled, which would lower our efficiency by lowering the L/C ratio and, secondly, there would be a tendency to set up parasitic oscillations. If the tubes were not reasonably alike, the power would not be evenly divided—which would be a third objection. Now if we change the parallel arrangement to push-pull, the capacity will be ¼ of what it was, there will be no tendency toward parasitic operations and the tubes will not have to be matched! This should be reason enough for using push-pull. Now it is the nature of a balanced push-pull stage to suppress all even harmonics when connected in the conventional manner. Therefore, such a stage could not be used for a doubler. It could be used as a straight amplifier or as a tripler, however. Before considering a suitable doubler arrangement, let us study Figure 3: (a) shows a simple one-tube multiplier which may be tuned to any harmonic of the input frequency, "f"; F(b) shows a conventional push-pull stage which, if symmetrical, has no even harmonic output, but which may be used on any odd harmonic. Unfortunately, space doesn't permit explaining the workings of push-pull stages, a discussion of which would make a full-size story in itself. Suffice it to say that the even harmonic outputs of each tube are 180 degrees out of phase with the other, and so their algebraic sum is zero; that is, they cancel. It is obvious that, if the arrangement is asymmetrical (not balanced), the voltages from each tube will not be equal so complete cancellation will not take place. The odd harmonics, on the other hand, are in phase and so add up to double the output of a single tube. Now suppose we cut the plate coil at the mid-point and electrically turn half of it around—reverse its leads or rewind it in the opposite direction. This causes a change of phase of 180 degrees in this half of the plate coil. Now, the even harmonics will be additive and the odd ones will cancel. This is pictured in (c). A single tuning condenser cannot be used in this case. However, if the two coils and condensers are equal, points A and B will be at exactly the same potential and in the same phase—so we may connect them—giving us (d). It should be noted that the grids are now connected push-pull while the plates are in parallel, and this gives us an efficient frequency-doubling stage with twice the output of a single tube.



STATION "J1AA," KEMIKAWA-CHO, JAPAN

This is the transmitter building, with the antenna arrays for this famous Japanese station which also uses a number of other calls including JYK, JYS, JYR, JYT for various wavelengths.

The DX Corner Short Waves

(*Continued from page* 91)

meter band has been excellent and he reports the Germany, England and French stations coming in with great volume. I2RO has been poor lately. The 19 and 16-meter bands have not been as good as the other bands. He also states that TI4NRH has *not* moved to Granada, Nicaragua. It is only off-the-air, temporarily, while Mr. Marin is in Granada helping install station YNCRD, which will be transmitting on 7170 kc. Mr. Marin will have TI4NRH back on-the-air, very shortly, if it is not already back.

A Report from China

Baron P. D. N. von Hoyningen-Huene, O.R.N.S.W.L.P.O. for China reports the following Best Bets: FZG, FZR, FZS, KAZ (Manila), KGPO (Honolulu), KKZ (Bolinas), PK2AG, PK3AN (Java), RAU (Turkestan), RIM, RKI (U.S.S.R.). His receiver is an eight-tube superheterodyne covering frequencies from 125 kc. to 20 megacycles. He is also the owner and builder of station AC2BHH.

Report from Canada

Mr. J. C. Atkinson of Minnedosa, Manitoba, Canada, reports the following Best Bets on a 2-tube, home-built set: W6XK, W3XAL, W2XE, W1XAZ, W2XAF, W9XF, VE9GW, W8XAL, W1XAL, FYA, GSD, PSK, EAQ, HJ1ABB, GSE, GSC, GSB, DJD, PRADO, W3XL, HJ5ABD, HCJB, VE9DN, W9XAA, VK2ME, VK3ME, CT1CT. (Thank you for your kind report from this district. The Editor).

A Report from British West Indies

Mr. R. J. G. C. Vyner, a new listener and a new subscriber just having purchased a new Hammarlund Comet "Pro" receiver reports Best Bets for Lacovia, P. O., Jamaica, B. W. I. as follows: W3XAL, W2XAD, W2XAF, W2XE, W3XAU, W1XAZ, W8XK, FYA, Germany on all wavelengths, Daventry on all wavelengths, I2RO, EAQ, HBL, YV3RC, YV5EMO and many others including South American stations. Says reception there has been free from static and with little fading except on W2XAF.

A Report from England

"Conditions not so good on the 49-meter band. On the 31-meter band reception has been excellent. W1XAZ, DJA, VK2ME, CT1AA, EAQ have been the best performers. The 25-meter band has improved greatly, FYA, RNE, W8XK, DJD, I2RO, W2XE, excellent. The 19-meter band has been fair with W3XAL good and W8XK and W2XAD good. The 14-megacycle 'ham' band has shown great improvement." This report is from our Official Listening Post Observer Mr. J. J. Maling. He uses a doublet converted "L" type antenna, 25 feet high and 20 feet long.

A Report from Chile

Jorge Izquierdo, RADIO NEWS reader and short-wave enthusiast of San Francisco de Mostazal, Chile, sends in the following list of Best Bets using a Victor 140 all-wave receiver: W3XAL, W2XAD, GSF, FYA, HVJ, W8XK, GSE, I2RO, DJD, EAQ, XETE, W3XAU, HBL, GSC, DJA, W2XAF, GSB, Byrd expedition, PSK, CNR, HJ3ABD, YV2RC, GSA, CP5, DJC, RNE. He reports the stations on 49 meters difficult because of static this month and stations W2XAF, DJA, GSC, FYA came in like locals.

A Report from Brazil

Mr. Louis Rogers Gray of Petropolis, Rio de Janeiro, Brazil, using a National FB7A superheterodyne and a 52-foot single-wire antenna supported on a 50-foot tower on the side of a hill, reports the following Best Bets: W3XAL, GSG, W2XE, FYA, W8XK, DJB, GSF, HVJ, W8XK, I2RO, DJD, GSD, CJR, LSX, EAQ, W3XAU, HBL, GSC, W1XAZ, DJA, W2XAF, GSB, HBP, LCL, HJ1ABB, YV3RC, W9XF, YV5BMO, GSA, DJC, RV59.

Another Report from England

The following letter has been received from Donald Burns, O.R.N.S.W.L.P.O. for England. "The following have been the Best Bets during March and April: W1XAZ, DJA, DJC, RV59, HBJ, W3XAU, OXY, W2XE, W8XK, EAQ, I2RO, LCL, HBL, CNR, CT1AA, FYA, W3XAL.

"The following have also been heard: YV2RC, W8XAL, VK2ME, PRA3, HJ4BB, W4XB, VE9GW, W3XL, EA8AB, LSX, W2XAF, W2XAD, PHI.

"I understand that I have been elected a member of the Society of Short-Wave Pioneers. May I add that the April issue of RADIO NEWS was the finest number devoted to Short Waves that I have ever had or seen.

"Wishing the DX section every success, Yours sincerely," (signed Donald Burns).

A Report from Missouri

Official Observer C. H. Long of Winston, Missouri, reports reception conditions "continued good on the 19, 25 and 31-meter bands. On the 49-meter band static has become troublesome. On the 19-meter band FYA, DJB and GSF are well received in the early mornings."

Best Bets from Alabama

Mr. L. T. Lee, Jr., of Union Springs, Alabama, sends in the following list of very Best Bets: VE9GW, HJ1ABD, DJC, GSA, GSC, GSD, COC, HC2RL, FYA, I2RO, EAQ. He includes another list of stations he heard during the last month that is so long we do not have room to publish them here. Most of them are included in the Short-Wave Time-Table.

Readers Who Helped Log Stations for This Month's Report

We are indebted to the following readers of RADIO NEWS who furnished important information in their reports of short-wave reception this month: Edela Rosa, San Fernando, Trinidad, B. W. I.; Mrs. E. Sturhahn, Atlanta, Ga.; L. S. Fixin, Werner, N. Dak.; F. W. Gunn, Gosfield, Essex, England; C. D. Hall, Chillicothe, O.; E. Hoover, Pittsburgh, Pa.; A. G. Taggart, Reedy Creek, Man., Can.; D. L. Donaldson, Kelty, Fife, Scotland; R. Leavitt, Los Angeles, Cal.; J. E. Cordy, Los Angeles, Cal.; C. M. Zimmerman, Allentown, Pa.; C. D. Wagoner, Schenectady, N. Y.; C. H. Long, Winston, Mo.; E. P. Samsel, Midland, Mich.; Toshitado Matsuyuki, Kemikawa, Cho, Chiba-ken, Japan; D. Burns, Pendleton, Salford, 6, England; L. Swenson, Eden, Idaho; R. Lawton, Whitefield, near Manchester, England; B. Scott, Corpus Christi, Tex.; L. R. Gray, Rio de Janeiro, Brazil; J. Izquierdo, San Francisco de Mostazal, Chile; W. M. Gammon, Guelph, Canada; A. H. Garth, Adelaide, South Australia; J. J. Maling, Diss, Norfolk, England; R. J. G. C. Vyner, Lacovia, Jamaica, B. W. I.; S. R. Ruple, Flint, Mich.; A. E. Emerson, Cleveland, O.; J. T. Atkinson, Minnedosa, Man., Can.; Baron von Huene, Tientsin, China; Wm. Kochnlein, New York City; E. H. Davenport, Pittsfield, Vt.; C. D. Moss, Dyersburg, Tenn.; Felipe L. Saldana, Huamantla, Tlax, Mexico; Heinie Johnson, Big Spring, Tex.; W. L. Cross, Antigo, Wis.; R. Wright, Brooklyn, N. Y.; R. Angulo, Cali, Colombia; R. Brophy, Montreal, Can.; Wm. Schumacher, Ellis, Kans.; H. S. Baird, Boston, Mass.; O. G. Lomelino, Lisbon, Portugal; H. J. Rud, Copenhagen, Denmark; Banmler, Berlin, Germany; J. C. Kalmbach, Jr., Buffalo, N. Y.; R. W. Mitchell, Winchester, Mass.; F. Waters, Charleston, Ill.; R. J. Leonhardt, Brooklyn, N. Y.; C. H. Skatzes, Delaware, O.; E. F. Bahan, Greenville, S. C.; N. C. Smith, Foots Cray, Sidcup, Kent, England; G. R. Bigbee, Fort Benning, Ga.; R. Woods, Sand Springs, Okla.; C. Pryor, San Francisco, Cal.; D. Smith, Woburn, Mass.; A. B. Baadsgaard, Ponoka, Alta., Can.; L. H. Colburn, Chertsey, Surrey, England; H. Adams, Jr., Baltimore, Md.; L. Deans, Selma, N. C.; S. D. Wood, Walkerville, Ont., Can.; J. M. Hostetter, Roanoke, Va.; Dr. G. W. Twomey, Ft. Snelling, Md.; G. K. Harrison, Hobbs, N. Mex.; K. A. Staats, Aliquippa, Pa.; L. T. Dentelhauser, State Sanatorium, Md.; R. S. Houghton, Lancashire, England; C. V. Fleming, Highwood, Ill.; F. J. Nicholas, Savannah, Mo.; P. J. Kecks, Pittsburgh, Pa.; A. H. Abernethy, Daytona Beach, Fla.; J. C. Hayes, San Rafael, Calif.; K. R. Boord, Smithfield, W. Va.; D. L. Ramsey, Struthers, O.; J. A. Klein, Felts Mills, N. Y.; J. F. Quigley, Des Moines, Ia.; F. B. Johnston, Crosbyton, Tex.; S. Tolpin, Chicago, Ill.; W. R. Hilton, Lockhart, Tex.; C. H. Armstrong, Atlanta, Ga.; N. Nuttall, Preston, Lancs, England.; J. E. Moore, San Francisco, Calif.; H. Woods, Rutland, Vt., F. C. Balph, Indianapolis, Ind.; W. Schumacher, Ellis, Kans.; D. W. Shields, Roseville, O.; J. O. Teeter, Hillside, N. J.; R. H. Pulver, Minneapolis, Minn.; S. H. Watson, Edmonton, Alta, Can.; W. Dixon, Plainfield, N. J.; R. Edkins, Transcona, Man., Can.; B. Starr, Buhl, Idaho; D. R. D. Wadio, Bombay, India; W. A. McAlister, Hopkinsville, Ky.; A. Hamilton, Somerville, Mass.; A. E. Emerson, Cleveland, O.; J. Hopkins, Whiting, Ind.; S. S. McNamara, Brooklyn, N. Y.

Send in Your Reports

The Editors acknowledge with thanks the assistance of public-spirited readers who have thus co-operated to make these columns so successful and helpful. Let us urge our readers, one and all, to continue, in even a larger way, to send in these reports. We would be grateful if every reader who hears even a single station would send it in to us with just the data as to its wavelength, its frequency, the time which it was heard, etc. Of course, we would prefer to get more information, including the Best Bets in each listener's locality, as well as definite logs of stations, their wavelengths and exact times of transmission. Copies of verification letters and station schedules are extremely valuable. Readers will also help by stating what type of receiver they use in logging these stations.

The Dragnet

(*Continued from page* 95)

the C battery through the choke should the antenna lead inadvertently contact the chassis.

This choke provides the input to a –34 tube. This is a high-gain, variable-mu r.f. pentode of the 2-volt type.

The output of the –34 is tuned by means of the coil L1 and condenser C2.

The rest of the detector circuit is conventional until we get to the plate circuit, where we find a "pi" type r.f. filter which consists of the resistor R6 and the condensers C6 and C7.

The output of the detector section of the 19 tube is coupled to the grid of the second section by condenser C5, with R3 and R4 as the coupling resistors. R2 is a 100,000 ohm potentiometer employed to control regeneration. It will be noted that the parts of Figure 1 which correspond to those of Figure 2 have been given the same symbol letters.

It should be noted that the on-off switch SW is of the d.p.s.t. type. This is necessary because unless the B battery circuit is broken as well as the filament circuit, the B battery will slowly drain off through the potentiometer R2, even when the filaments are turned off.

The plug-in coils employed in this receiver are of the home-made variety with winding specifications as given in Table 1 and Figure 4. Following the idea of using extremely high-grade insulation throughout, Hammarlund Isolantite forms were employed.

The Hammarlund forms used in the coils covered in the specifications of Table 1 are 1½ inches in diameter and are of the 4-

prong type. If the constructor makes his own coils it is important that the forms he uses be of this same diameter, otherwise the ranges will be different than those shown in the table.

In general it will be noted that the ticklers employed are somewhat smaller than usual. This is done in order to permit the use of higher plate voltage with resulting higher detector output. For best results, the ticklers should be of such size that the regeneration control potentiometer can be operated in a well advanced position.

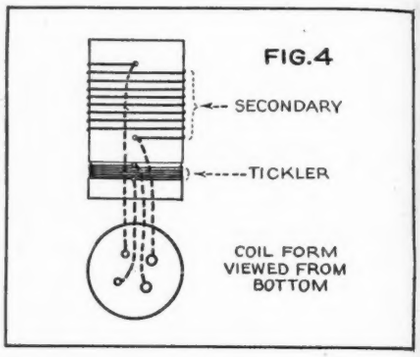
The coils covered in Table 1 provide plenty of overlap. At first glance it may seem that the overlap between coils 1 and 2 is unnecessarily large but this is intentional. The greatest sensitivity is obtained when using relatively little tuning capacity in the tuned circuit. To provide best operation, therefore, it is desirable that the coil ranges be so selected that the most desired stations will come in at low settings of the tuning condenser. In the case of coil No. 1, the range is 15.8-28.0 meters. Thus the 16 and 19 meter short-wave broadcast stations will be tuned in with a highly favorable inductance capacity ratio. The 25-meter stations, on the other hand, would come in near the top of the dial where efficiency would be less. For this reason the range of coil No. 2 is made to include the 25-meter band close to its high-frequency end and the 30- and 31-meter bands as well. The 50-meter stations are also well down on the dial of coil range No. 3.

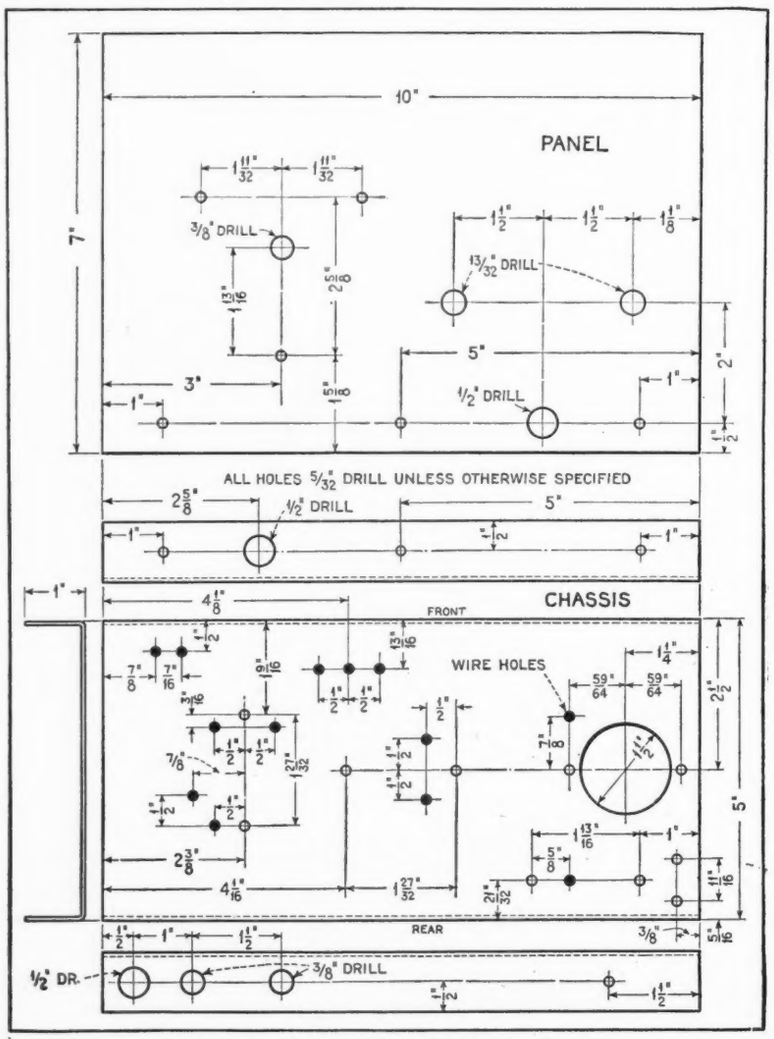
By disregarding this factor of efficiency it would be possible to cover from 16 meters to 200 meters with 4 coils instead of the 5 employed but the sacrifice of efficiency involved is not believed to be worth while.

The coil socket is mounted on bushings to keep the coil well up from the metal chassis. The 19 tube socket is similarly mounted, but in this case the purpose is to avoid carrying r.f. leads underneath the chassis. Insofar as possible all r.f. wiring is kept above the chassis and all a.f. or d.c. wiring below the deck. This makes

COIL CONNECTIONS

Figure 4. In making the coils the secondary and tickler coils are wound in the same direction with terminals of windings connected to prongs of forms as shown by the broken lines





PANEL AND CHASSIS SPECIFICATIONS

Figure 5. The panel and chassis should be cut, bent and drilled in accordance with dimensions given here

for short leads in the r.f. circuits and helps to isolate the r.f. circuits from the others.

So far as the constructional details are concerned there is little that can be said which would add to the information provided by the photographs, the chassis specifications (Figure 5) and the picture wiring diagram (Figure 3). It is not absolutely essential that the panel and chassis be of metal. The metal does, however, eliminate body capacity and provide general shielding, and for that reason is considered worth while, especially as the cost of the aluminum is low.

One or two pointers concerning the wiring may be helpful to the novice who builds this set. For instance, it is advisable to mount all parts on the base and to wire them as far as possible before attaching the panel. Wires of suitable length should be soldered to the terminals of the sockets for the coil and the type 19 tube before mounting these sockets, then, in mounting them, thread through the holes in the chassis the wires that are intended to go beneath this base. Wires of adequate length should also be soldered to the rheostat terminals before the panel is mounted on the base. With these precautions the wiring will be found easy.

The "Dragnet" is designed for battery operation. Two standard dry cells are employed for the filament supply, a 4½ volt C battery and three 45 volt B blocks. Heavy duty B blocks are not necessary inasmuch as the plate current drain is only a few milliamperes.

The R. N. "Dragnet," a name selected because of the demonstrated ability of this little receiver to drag in just about everything on the air, will be found extremely smooth in operation and absolutely stable.

TABLE I - COIL DATA

	Secondary Turns	Tickler Turns	Frequency	Wavelength
No. 1	6	6	19000-10700	15.8- 28.0
No. 2	10	7	13000- 6610	22.5- 45.4
No. 3	18	9	7230- 3830	41.5- 78.3
No. 4	30	12	4150- 2250	72.2-133.3
No. 5	50	20	2380- 1220	126.0-245.8

Wire Sizes:

No. 22 double silk covered wire is used for all secondary windings except No. 5 and this is No. 28 d.s.c.

No. 28 d.s.c. wire is used for all ticklers

Spacing Between Ticklers and Secondaries:

No. 1 coil—3/16 inch
No. 2 coil—⅛ inch
No. 3 coil—⅛ inch
No. 4 coil—3/32 inch
No. 5—⅛ inch, tickler wound in 2 layers

Secondary Turns Spacing:

Coils 1, 2 and 3 are space wound to make secondary windings 1½ inches long.

Coils 4 and 5 are wound without spacing.

List of Parts

C1, C7—Aerovox type 1467 miniature fixed condensers, .00025 mfd.
C2—Hammarlund MC-140M, 140 mmfd. midget "Midline" condenser
C3, C6—Aerovox type 1467 miniature fixed condensers, .0001 mfd.
C4, C5, C9—Aerovox cartridge type by-pass condensers, .1 mfd., 200 volts.
C8—Aerovox cartridge type by-pass condenser, .5 mfd., 200 volts
L1, L2—Plug-in coils wound on 4 prong forms (see text)
R1—5 megohm pigtail type resistor, ½ watt
R2—Centralab potentiometer, 100,000 ohms
R3—100,000 ohm pigtail type resistor, ½ watt
R4—1 megohm pigtail type resistor, ½ watt
R6—15000 ohm pigtail type resistor, ½ watt
R7—Yaxley "Junior" rheostat, 10 ohms, with knob
R.F.C.—Hammarlund type CH-8, r.f. choke 8 millihenry
2—Hammarlund type S-4 Isolantite 4 prong sockets (1 for coil, 1 for Type -34 tube)
1—Hammarlund type S-6 Isolantite 6 prong socket (for type 19 tube)
SW—1 Toggle switch, d.p.s.t.
1—Kurtz-Kasch vernier dial, 2¾ inch
1—Midget porcelain stand-off insulator, 13/16 inch high, (used for antenna terminal)
2—Insulated 'phone tip jacks
1—Binding post (for ground terminal)
1—5-Wire color coded battery cable, length optional
1—Rubber grommet (for protecting battery cable where it passes through rear of chassis)
1—1½ inch bakelite knob (for R2)
Aluminum panel and base (see Figure 5)

Hearing-aid Radio

(*Continued from page 82*)

radio-frequency tube shield (X-Figure 2) in the hole which helped support the loudspeaker. Put the choke in place with its end against the projecting side of this angle and solder its shell to the angle. To steady the opposite end of the choke, an angle is made from a ⅛ inch by ⅜ inch by 1¼ inch piece of brass, bent to a right angle ½ inch from the end; a 3/16 inch hole is drilled into the center of the short end and is slipped over the projecting end of the microphone transformer mounting screw and fastened with a 10/32 nut. Then bend the angle against the side of the choke and solder to the shell. This will hold the choke securely in place. Connect the choke between the screen grid and plate of the 38 output tube.

Next, the Universal Model A microphone is prepared for mounting. A "Daisy" fruit jar opener which is provided with lugs is used to mount it. Cut four slots 90° apart for the microphone lugs. Cut these through at the rear of the fillet on the inside of the opener. Slip it on the microphone, working the microphone lugs through the slots. Then, trim the excess rubber off the back, flush with the back of the microphone. Now, punch holes through the lugs of the rubber jar opener ring with an ice pick. Make two brass strips (A, Figure 1) 1/16 inch by ½ inch by 3¼ inch, with 5/32 inch holes drilled 3/16 inch from each end. Fasten these strips (which are to support the microphone) at one end with No. 8/32 flat head screws, ½ inch long in the holes that were used for the loudspeaker at the front of the chassis. Use lock washers under the nuts. Now file points on two No. 8/32 round head screws, ¾ inch long, to go through the upper holes in these metal strips into the holes punched into the jar opener lugs. Use nuts on these screws after mounting the microphone in place on the top end of the brass strips.

Next, mount the resistor (R1) for microphone current supply by drilling a 3/16 inch hole in the chassis behind the volume control, 1⅝ inches from the front and ⅝ inch from the end. Use a No. 10/32 r.h. screw, 2½ inches long, and nut. Use fibre

washers at each end of this resistor, one between the chassis and resistor and another under the head of the screw. Connect R2 between the top connection of R1 and the bare wire connection on the volume control. This bare wire is a set ground. Do not allow this or any other connection to contact the chassis. Connect the lower end of R1 to the screen grid of the 38 output tube.

Now connect a 10 mfd., 25 volt, tubular dry electrolytic condenser across R2. This condenser is to filter the microphone current. R2 protects it from high voltage when the switch is thrown for telephone amplification. Mount the condenser in a vertical position beside the 9000 ohm resistor, toward the front of the chassis as shown in Figure 2.

Connect the two toggle switches so that they can later be fastened on the front panel over the volume control. Dimensions for the mounting holes in the front panel will be given later. Sw2, a d.p.d.t. switch is the microphone current supply-telephone connector switch. Bring the microphone transformer primary leads up over the volume control. Twist them together and cut off with two inches extra length of wire, measuring to the upper corner of the radio cabinet. Solder these wires to the center terminals of this switch. The terminals on one end of this switch are connected; one to the junction of R1 and R2, the other to the center terminal of the microphone. The ground terminal of the microphone is connected to set ground (not the chassis) at the junction of the R2 and the receiver volume control terminal.

Mount a .25 mfd., 400 volt condenser under the chassis at the end under the volume control. One side goes to the 38 plate, the other side to one side of a twin 'phone jack. A second, similar condenser is put in the opening underneath the microphone between the microphone transformer and the chassis. One end of this condenser is connected to the other terminal of the twin 'phone jack, the other end goes to the set ground.

Unsolder the grid lead of the 38 tube at the cap clip and solder a three inch wire in its place. Connect the switch Sw1 in this lead so the radio circuit can be broken. Bring the grid lead of the microphone transformer directly to the grid clip of the 38. Solder the filament lead of the transformer to set ground. Thus, the radio circuit can be opened by the switch but the microphone transformer is always connected.

Next, a Wirtco miniature flat connector is arranged with the male half (P) supplied with 2 inch insulated leads which are soldered to the connection in the remaining end of the d.p.d.t. switch. The female half is connected with a No. 103 Birnbach, five foot cord with pin and spade tips. The spade tips are left on to go to the telephone connection, the pins are removed and the ends go to the connections in the female half of the connector. This is shown, plugged into the top of the set in the front view photograph.

Next, lay out and drill three holes in the top front of the radio cabinet over the volume control. Two ½ inch holes, 1 inch from the top and ⅞ inch and 2⅜ inches respectively from the ends of the cabinet. A 5/32 inch hole is drilled central between the ½ inch holes and ⅝ inch from the top of the cabinet.

Cut a rectangular opening in the top of the cabinet ½ inch wide by ⅞ inch long, ⅛ inch from the front and 1¼ inch from the end of the cabinet.

Cut the cardboard away from behind the ½ inch hole to permit the switch to slip through.

The male half of the connector plug is held by a ¾ inch roundhead screw through the hole to be found in its center.

Take a neat appearing brass drawer pull and fasten it in the center of the top of the cabinet to provide a ready means for transporting the outfit.

The radio can now be replaced in the cabinet, slipping the switches through the ½ inch holes in the front, and fastening the male half of the telephone connector plug with its screw through the small center hole.

The 1½ inch holes in the back cover are each filled out at the top of the cover to accommodate double 'phone jacks. The one on the right facing the back of the set is for the phone jack already described in the plate circuit of the type 38 tube. The other is to provide means to plug in the aerial. The aerial which was cut off six inches from the chassis, is now soldered to both terminals on the jack so the aerial will work in either place. A single insulated tip jack may be used instead, if desired. Solder a pin tip on the end of the long aerial to plug it in.

Use a single or double headphone of 1000 ohms d.c. resistance or more. A 2000 ohm potentiometer type "Modu-plug" is used for controlling the hearing aid volume. An extension cord may be used between the set and the volume control (the writer uses a twenty foot cord) although a little volume is lost. A four foot 'phone cord is about right.

The set is now ready for test. Plug in the aerial, also the headphones—but do not connect the telephone yet.

Plug the set into any 110 volt line, d.c. or a.c. See that the Modu-plug volume control is full on and operate the switches. In one position of the d.p.d.t. switch the sounds of the room should be heard regardless of the position of the other switch. If this operation is obtained, advance the radio volume control and try to tune in a radio station. Should none be heard, throw the s.p.s.t. switch. It should now be possible to tune in a radio program and at the same time the room sounds will continue to be heard. If this is O. K., again throw the s.p.s.t. switch to cut off the radio program—the room sounds will continue to be heard. Next, operate the d.p.d.t. switch and the room sounds will cease and nothing will be heard, excepting possibly a slight hum. Take the telephone connector cord, which is not yet to be connected to the telephone and plug it into place in the other half through the rectangular opening in the top of the cabinet. If the spade tips on the end of the cord are put together, a click will be heard, if all connections are O. K.

To test the telephone circuit connections, get a 45 volt B battery and connect one end of the Trimm headphone cord to plus 45 and the other headphone tip to one of the spade tips. Connect an insulated wire to the minus side of the battery, the other end of the wire is left bare for perhaps ¼ inch to be used for an exploring point. Disconnect the set from the power line, and while listening to the headphone, use the exploring point to touch the set ground, and the chassis, and the other spade terminal. A loud click should be heard only when the other spade terminal is touched. If a loud click is heard when the set ground or chassis is touched then note the telephone circuit is not insulated and it must not be connected to a telephone instrument till the trouble is found and corrected. Check from both terminals. If this checks, the telephone receiver can be lifted off the telephone, the hook weighted down to prevent the telephone from operating, the receiver ear cap unscrewed, the spade tips slipped through the hole in the end alongside the telephone wires and one spade tip fastened under each telephone receiver screw; on top of the regular telephone spade tips.

It should be pointed out here that many local telephone companies do not permit any equipment to be connected to their instruments. The telephone-amplifier feature is included in this hearing aid-radio for the benefit of those not served by such companies and can be omitted if desired.

The telephone connector cord is thus connected in parallel with the telephone receiver. It must not be connected in series as the telephone will be out of service unless the circuit is completed in the radio, and we want to be able to disconnect the plug at the radio; leaving the female half attached to the telephone, and still be able to use the telephone in the usual manner.

Lifting the weight off the telephone receiver hook, the amplified telephone signal can now be heard in the Trimm headphone.

The switch positions are now marked, if desired, to enable easy operation. As many aerials are put up as desired in different locations.

Telephone connecting cords and plugs; that is, female halves, may be placed on as many telephones as may be desired. These connectors and also the telephone circuit in the radio must be installed carefully and maintained in perfect condition. Otherwise trouble will ensue.

Parts List

C1—10 mfd., 25 volt dry electrolytic tubular condenser
C2, C3—¼ mfd., 400 volt tubular bypass condensers, .25 mfd., 400 volts
Ch—Output choke; impedance suitable for 38 tube
HP—Trimm Featherweight headphone, 1000 ohm type
M—Universal Model A microphone, sensitive type
MP—Centralab 20,000 potentiometer "Modu-plug" with as long a cord as desired
P—Wirtco miniature flat connector
R1—Electrad 9,000 ohm wire-wound resistor
R2—1,000 ohm wire-wound or metallized resistor
SW1—H & H, s.p.s.t. toggle switch with ⅜ inch neck
SW2—H & H, d.p.d.t toggle switch with ⅜ inch neck
T—Thordarson No. 2357, single-button microphone transformer
1—General Electric, Model M-40 a.c.-d.c. compact type radio set
1—"Daisy" fruit jar opener with lugs
3—Brass drawer pulls
1—No. 103 Birnbach, 5 foot cord, pin and spade tips
Assorted hardware as described

Mr. Simer will be glad to answer inquiries from readers concerning the equipment covered in this article. Inquiries may be addressed to him, in care of RADIO NEWS.

—The Editors

All-Wave Design

(*Continued from page* 100)

represent entertainment under average favorable local noise conditions.

Requirement (f) of full coverage is vitally important. Full coverage includes all frequencies from 540 kc. to about 23,000 kc., the limits of the American broadcast and foreign short-wave bands, and including all services such as police, amateur, airport and broadcast.

Requirement (g) of ease of operation and dependability covers much territory. In terms of controls, it necessitates as many, but no more than are necessary to obtain maximum possible results at all times. There should be one single tuning control, having smooth, positive and easy adjustment, and with at least two tuning ratios. One ratio can be about 10:1 for the broadcast-band tuning, and one ratio should be about 40:1 for short-wave stations. A volume control should be provided, and a tone control to meet individual tastes and for noise reduction, and, of course, a solid, substantial and trouble-free wave-change switch.

In addition to this, an audio-beat oscillator is valuable to assist in locating short-wave stations.

Leaving much unsaid for lack of space, a receiver to embody all of the above important features will need no less than and no more than nine tubes, which may best be a 58 tuned r.f. stage; 2A7 electron-coupled oscillator and first detector; two 58 air-tuned, 465 kc. amplifiers; 55 diode second detector, diode automatic volume control and Class A triode first audio stage; two 2A5 pentodes operated as high-mu Class A prime power triodes; and one 5Z3 rectifier.

Having followed out the reasoning briefly outlined above, let us finally put into practice the old Chinese proverb that "one picture is worth a thousand words," and examine a new receiver, a product of my laboratory, which embodies these desired features, by means of pictures and a circuit diagram.

The photograph illustrates the completed receiver and the diagram gives the schematic circuit. At the center of the chassis is a three-gang tuning condenser with its calibrated airplane dial which tunes the r.f. stage, first detector and electron-coupled oscillator circuits. To the right of this, from front to rear, are the polished aluminum shields housing the r.f., first detector and oscillator inductances for the broadcast band, while the 58 r.f. amplifier and 2A7 first detector-electron coupled oscillator are just to right of these inductance shields. From right front to left rear, the shields and tubes are: first i.f. transformer, first i.f. amplifier tube, second i.f. transformer, second i.f. tube, third i.f. transformer, 55 second detector, a.v.c. and first audio tube, beat oscillator tube, beat oscillator coil and condenser assembly in shield similar to that used for i.f. transformers, two 2A5 Class A prime power output amplifiers, 5Z3 rectifier tube, and at the left front the filter choke and power transformer.

The controls are lower left, noiseless, tapered volume control and on-off switch; lower center, four-position wave-change switch; above it the beat oscillator toggle switch; and lower right, the tone control. Just below the airplane dial are seen two concentric knobs. The larger one is for 8:1 ratio broadcast band tuning, functioning through a beautifully smooth and positive automatic take-up gear system to operate the ball-bearing tuning condenser. The upper or smaller knob is the 40:1 ratio tuning adjustment for use on short-wave tuning and is probably as sweet a control as has ever been developed. It is so smooth and easy that the set can be tuned by simply rubbing the finger against this knob, and with absolutely no play or backlash, it makes short-wave tuning a delight. The airplane dial has a full 270-degree scale, giving one and a half times the dial spread for the narrow, short-wave bands of the customary 180-degree dial scale.

The four wave ranges of the receiver are:

540 to 1500 kc.
1500 to 4600 kc.
4700 to 13,000 kc.
9000 to 23,000 kc.

Capt. Hall's Page

(*Continued from page* 92)

sends us an early morning Sunday "special" from 7:30 to 9 AM. EST. A powerful carrier. Then sweet, sad music. Oriental in style. Extremely long pauses then a brusque voiced Frenchman says, "Hillo, Hillo, Radio Rabat dans Maroc." Morocco, known for their sheiks; shoes turned up at the tips; camels, date trees and scattered oasis.

Now to log the formally impossible Asia. Japan has been coming on the air at 5 AM. EST. giving news flashes then changing to their typical "Jap stuff." We may hear them on either 30.4 meters or 38: meters using either J1AA for a call (or phantom call letters) thought up by an ingenious announcer. JLY maybe one or JLK another—but it is only J1AA under an assumed name. If we do hear this truly occidental station we will have touched all the continents within twenty-four hours and are ready to continue on our true course again.

Back to England only this time of the morning they will be on 19:82 meters with the Vatican station, HVJ just a dials breadth away (19:84 meters)

PHI (16:88 meters) Huizen, Holland will identify themselves in seven languages, and be on until approximately 10:30 AM.

You who have not listened to Germany (on 19:73 meters) have missed something wonderful. They actually are like a local station for quality, volume and clarity. Breath taking reception is yours on the 19-meter band.

Testing with music around 10 AM. you will undoubtedly find RNE, Moscow. U.S.S.R. operating (on 25 meters). Too early for the lady announcer but if we hear Moscow, that is all that matters.

Again we can travel to Rome, Italy; Paris, France; Daventry, England; and Germany. They are all awaiting our beck and call.

"Rabat dans Maroc" will be back with us again at 2:30 PM. and leave us exactly at 5 PM. (EST) This time on 37:33 meters, but rarely heard with as much volume as during their early morning transmission. Remember this station is only active on Sunday although they do use the same channels for phone contacts on week days.

If we had of started our cruise on Saturday morning instead of mid-day we could have listened to the twin station in Australia. i.e. VK3ME, 31:55 meters, Melbourne. Who is only active on Wednesday from 5 to 6:30 AM. and Saturday 5 to 7 AM. (EST)

Here are two stations that we should all be hearing. The new Australian VK3LR (31:3 meters), Melbourne, Australia. Heard as early as 3 AM. sending the latest stock reports and relaying the programs originating in the long wave studios of various broadcasting studios throughout Australia.

XEBT (49:44 meters) Mexico City with a most irregular schedule. Heard here as early as 8 PM. and sometimes staying on until 2 AM. The address of this new station is Radiodifusora XEBT, Apartado 7944, Mexico City.

Dear Reader. We want to conduct this column to suit your individual taste. We can only accomplish this through your co-operation. A line from you on your reception results will help us all. New catches, calls or as one chap put it, "something unusual" will be gratefully accepted as news items for a feature of these articles, that is—the ever present "mail-bag." This will start next month. Let the reader in the middle west know what you on the coast are hearing so he can try for it. And the east coasters will just have to work so much harder to pull your "catches" across the continent.—Capt. H. L. Hall.

The Technical Review

(*Continued from page* 109)

52. *The Servicer.* Contains information designed to help the serviceman do better work and make more money doing it.

56. *Quick Facts on Testing Instruments.* Information on the essential features of the most important new testing instruments such as the new Model 85 tube tester, the new Model 91 analyzer, the Model 333 radio analyzer, the Model 35 tube tester, the Model 60 oscillator, the multi-wave signal generator Model 180, the new standard diagnometer, the Model 222 multometer and the Model 111 d.c. volt-ohmmeter.

57. *A High-Quality Condenser or Ribbon Microphone.* A microphone kit with which it is possible to build, easily and quickly, a high-quality condenser or ribbon microphone.

59. *The Volt-Ohmmeter.* Characteristics and uses of the International Resistance Co. volt-ohmmeter, a combination voltmeter and ohmmeter especially designed for the point-to-point method of trouble-shooting.

60. *Transformers and Choke Coils.* Information on the characteristics of a wide variety of Amer-Tran DeLuxe and standard audio and power transformers and chokes.

63. *Moderate-Priced, High-Quality Transformers and Chokes.* Descriptions and prices on the new AmerTran Silcor line of moderate-priced audio and power transformers and chokes designed for original and replacement use in radio receivers, amplifiers, public-address systems and amateur transmitters.

Dual-Range Super

(*Continued from page* 98)

intermediate-frequency amplifier. The plate circuit is then coupled to the diodes by means of an intermediate-frequency transformer and the signal is rectified. The rectified signal is now put on the grid of the pentode section again; at the same time, the automatic control voltage is taken off and fed to the control grids of first detector and first intermediate amplifier. The plate circuit of the pentode section contains a resistor which serves as the load at audio frequencies while the radio frequency has been filtered out by the combination choke and condensers.

The receiver is supplied with an airplane dial having two scales. When the receiver is working in the broadcast band the upper half of the scale is illuminated, this upper half is calibrated in frequencies. The lower half of the scale is illuminated when the receiver is used in the short-wave range. The four foreign short-wave broadcast bands are indicated on this lower scale, making it very easy to locate these stations.

According to the manufacturers the best type of antenna for this receiver should have an overall length from 25 to 30 feet for best reception on short-waves. This length will be satisfactory for the broadcast band also.

The Emerson receiver was tested at the Westchester Listening Post during the weekend of the 26th and 27th of May, 1934. During this time practically all of the larger stations in Europe, South America and Australia could be tuned in with ease. The log contains, for instance, all of the British Empire short-wave stations, all of the German short-wave stations and such famous calls as VK2ME, Sydney, Australia, HJ1ABB, HJ4ABE, PSK, etc. The calibration on the short-wave band proved to be accurate and tuning was accomplished easily. On the broadcast band some semi-long distance was tuned in during the day time.

Short-Wave Kit

(*Continued from page* 98)

resistors. The set employs a –58 type tube as an untuned radio-frequency stage, a –57 as a regenerative detector and a 2A5 as output stage; the rectifier is a type –80.

The untuned radio-frequency stage adds considerably to the sensitivity of the set. However, it serves another very important function in that it isolates the regenerative detector from the antenna, thereby preventing radiation when the detector is oscillating. Such a blocking tube is highly desirable with regenerative sets for without it receivers of this type create interference over large areas.

The –57 is at present the most sensitive tube available for detector service; it is used here in a circuit which has proven to be highly satisfactory. Regeneration is controlled by varying the screen voltage because this method has the least effect on the tuning.

Now we come to the tuning arrangements. There are two condensers used in the tuned circuit: a 140 mmfd. main condenser and a 20 mmfd. vernier or trimmer. These two condensers can be hooked up in two ways. In the standard model, the larger condenser is controlled by the main tuning dial and the smaller condenser serves as a trimmer for fine adjustments. The special model employs the same condensers but the smaller one is controlled by the main dial and the large condenser

occupies the lower position on the panel, thereby serving as a band-setting condenser. This arrangement allows continuous band-spreading. Amateurs and others who wish to spread certain bands can use this system to advantage.

Special 6-prong plug-in coils have been designed for use with the "Trophy-Winner." They have three windings: primary, secondary and tickler.

The output stage can deliver ample power for a dynamic or magnetic speaker. As shown in the diagram, two sets of output terminals are supplied. Those marked "H. I." (high impedance) are connected directly to the tube through a blocking condenser. The primary of the output transformer then serves as choke. These terminals should be used for a magnetic speaker or for headphones. The secondary of the transformer connects to the other set of terminals. These should be used for a 10 ohm voice coil. A special a.c. operated dynamic speaker is available for use with the set.

The power unit is connected to the set through a 8-wire cable and a 6-prong plug. Each filament lead consists of two wires in parallel, so as to minimize losses in the cable. The power line itself is fed through the cable, connecting to the on-off switch on the receiver panel. This concentrates all controls at one point.

During tests of this receiver at one of the RADIO NEWS Listening Posts loudspeaker reception of stations in Argentina, England, Germany and France was obtained without difficulty.

S. W. Converter

(*Continued from page* 99)

circuit. In addition, of course, this i.f. stage provides additional amplification which provides a good husky input for the broadcast receiver, and thus contributes to a low noise level.

Interchangeable coils are used in the converter. These are of the drawer type, the drawer being inserted in the front panel of the converter. The detector and oscillator coils for each wavelength range are included in a single drawer and are thoroughly shielded from each other by the drawer construction, which is of copper. The tracking condensers for each range are included in the drawer, thus providing for accurate individual alignment. Coil drawers are available for all the short-wave ranges.

When tuning in short-wave stations, all tuning is accomplished by means of the single control on the face of the converter. The airplane type dial, calibrated on a 270 degree arc, coupled with the high vernier ratio of the tuning control, make for simple tuning and accurate logging of stations.

The unit is inclosed in a crackle finished metal case and is equipped with 2 antenna binding posts to provide for using either the ordinary or the doublet type antennas. The overall size of the converter is 8½ inches by 9½ inches by 6 inches deep.

Rating Tests

(*Continued from page* 99)

offering entertaining programs, and radio receivers with which the user could intercept the programs. Up until 1924, the public's use of the radios constructed by reputable companies was of little concern with respect to fire hazards since the power required for operation was usually obtained from a primary or storage battery involving potentials generally not exceeding 100 volts.

Subsequent to this period, however, manufacturers introduced the "A" and "B" eliminator, and soon afterward the power-operated radio receiver. Both of these devices depended for their operation upon connection to a power or lighting circuit. With the advent of this change, radio tubes were constructed to perform at higher voltages, easily obtainable with the step-up transformer in the a.c. receiver or separate eliminator. Reputable radio manufacturers took well conceived measures to eliminate possibilities of accident. With the same idea in mind, Underwriters' Laboratories, Inc., established an Industry Conference for Radio Appliances for the purpose of discussing proposed or revised

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standards affecting these various devices.

As a result of the work of this Conference Underwriters' Laboratories' Standard for Power-Operated Radio Receiving Appliances has been published. It is based upon the results of field experience and actual laboratory tests as follows: A rating test is made to insure that the marked rating is the actual rating of the radio device. A temperature test provides for the measurement of the temperatures of the various parts of the equipment so that the suitability of the materials used and the possibility of ignition may be ascertained. A maximum voltage test is conducted for the purpose of determining the voltage of the several circuits. A dielectric strength test provides for certain factors of safety for the insulation depended uptn to isloate the several circuits.

In addition to tests, the selection of materials for the purpose of insulation, bushings and housing, the use of listed parts, spacings between live parts, and other less important construction details are covered by the Laboratories' inspections and standards. Receivers found to be acceptable are listed by the Laboratories, this information appearing on published listing cards distributed to inspection departments and in the published List of Inspected Electrical Appliances. **J. W. Fulmer,** Asst. Electrical Engineer, Underwriters Laboratories.

R. N. Multimeter

(*Continued from page* 79).

scale deflection and the sensitivity 1000 ohms per volt. Now let us assume that we had to check a circuit of, say, 1000 volts. If we placed a 3 ohm shunt across the meter the circuit would draw 10 ma. at full scale deflection and the sensitivity would be 100 ohms per volt. Since the change in meter resistance through the introduction of the shunt would be negligible in comparison with that of the multipliers our voltage ranges would then be 100/500/1000/5000. Practically speaking, this expedient should not be resorted to with a 1 ma. meter as the multiplier resistors are not rated to stand much in excess of 1 ma. With a 100 micro-ampere meter, however, which, when so shunted requires but 1 ma., this idea is practical and desirable.

Due to the high internal resistance of the 100 microampere meter employed, the process of shunting the meter to 1 ma. to increase the ranges, is not as simple as the system illustrated above. Since the internal resistance is 2000 ohms at 100 microamperes and 200 ohms when shunted for milliampere, the difference of 1800 ohms is by no means negligible in comparison with that of the multipliers. Our solution illustrated in Figure 3b, is to build up the resistance again to 2000 ohms, by using an inexpensive 1800 ohm resistor. Thus we may use the same multipliers and obtain the following voltage ranges, .5/1/2.5/5/10/25/50/100 at 10,000 ohms per volt d.c. and 5/10/25/50/100/250/500/1000 at 1000 ohms per volt, both a.c. and d.c.

The construction and applications of this tester, together with the means used for capacity measurement, will follow next month.

The Service Bench

(*Continued from page* 107)

tributing organization throughout the country in preparation for a selling campaign on their all-wave sets. A good chance to ride in on the Sparton band

wagon *** R. C. A. has a new tube-agency plan well worth looking into *** Sylvania's new Radio Log contains baseball dope which keeps it in sight throughout the season (They cost $1.75 per hundred with your own imprint) *** National Union is backing up their representatives with full-hearted sales and technical co-operation *** *The I. R. C. Servicer* is another monthly service bulletin that is doing its bit in keeping the serviceman on his toes *** G. E. is inaugurating a country-wide approved-auto-radio-installation station plan. We understand territory is open to well-established servicemen and dealers with specialized equipment.

With the Experimenters

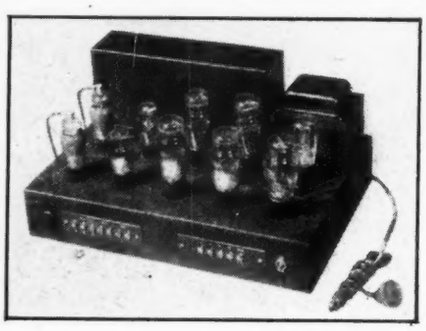
(*Continued from page* 111)

One 4.5-volt C battery
One push-pull transformer with split windings
One box

HARRY SCHMIDT,
Richmond Hill, L. I., New York.

New Things in Radio

(*Continued from page* 75)



stallation in large halls, auditoriums, county fairs, athletic fields, conventions, etc.

New P. A. System

The Bud Speaker Company has an interesting announcement for sound engineers, dealers and servicemen in their new portable sound-reproducing system designed for inside and outdoor use. The equipment comprises a condenser type microphone available in four different styles, a combination power supply and amplifier and an 8-inch permanent-magnet dynamic

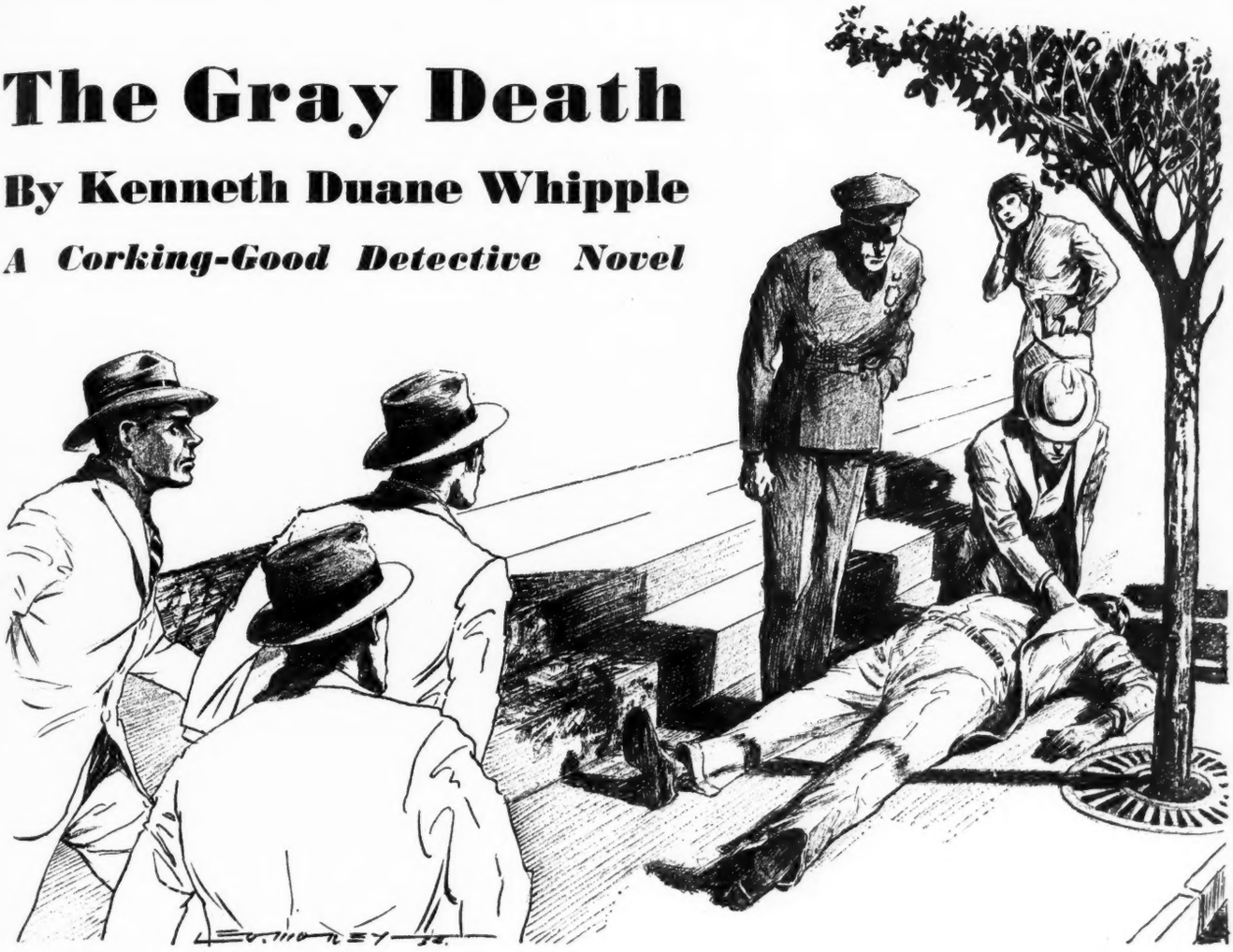
type cone speaker. The complete apparatus has been developed under new constructional principles to stand up under hard usage and all weather conditions but still be of attractive design for inside application. The speaker is made with the new type parabolic reflector baffle and speaker housing. The equipment also includes a speaker stand, connecting cords and cables and a single-action or an automatic turntable. A complete P.A. system of this kind can be quickly assembled and installed.

LONDON—A system of patrolling by radio police cars, such as used in New York and other American cities, is to be introduced into the metropolitan district, here, to lower the crime rate.

The Gray Death

By Kenneth Duane Whipple

A Corking-Good Detective Novel



A few minutes before, the guards at the Capitol had been startled by this young man's erratic racing through the streets of Washington as though Death were close behind! And, suddenly, there had been a fleeting glimpse of something shining and shimmering—a soft whisper of wings as of some gigantic bird—and he toppled over—dead!—his face an odd, putty-like gray!

Score One for the Gray Death! For it was Jerry Stannard, star operative of the Secret Service who lay there dead! He had dared to combat the maniac who threatened to empty the vaults of the U. S. Treasury—and death had followed with lightning swiftness!

Who was this brilliant madman against whom the Secret Service was powerless? What mysterious weapon did he own that caused such instantaneous death?

The answer will be found in "The Gray Death" by Kenneth Whipple—a new, full-length novel in the August COMPLETE DETECTIVE NOVEL MAGAZINE—the periodical that brings a new, complete detective novel in every issue, before publication in $2.00 book-form, for only 15c! Buy a copy today!

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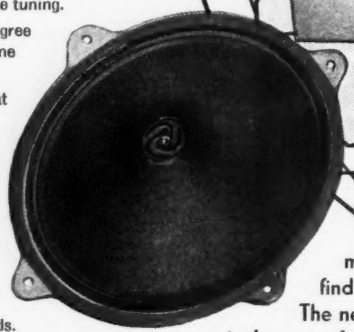

- Laboratory precision custom built throughout.
- Range 13 to 560 meters (23,000 to 540 kc.) in four bands with no gaps. GETS EVERYTHING ON SHORT WAVES.
- NINE LATEST TYPE TUBES: '58 tuned r.f. stage on all four bands, 2A7 electron coupled oscillator-first detector, two '58 air tuned i.f. stages, '55 second diode detector, diode A.V.C.—first audio, '58 electron coupled audio beat oscillator, two 2A5 triodes push-pull Class A Prime and 5Z3 rectifier.
- Sensitivity better than ⅗ microvolt per meter.
- Selectivity absolute 10 kc. at all wave lengths.
- Fidelity flat to 6 db. from 30 to 4000 cycles.
- Ten watts undistorted power output.
- Exceptionally low noise-to-signal ratio that makes foreign reception actually possible EVERY day.
- Dual ratio single tuning dial—8:1 ratio for broadcast band and 40:1 for easy tuning and separation of sharp short wave stations. Totally new, smooth, easy and positive tuning.
- Accurately calibrated, 270 degree illuminated full vision airplane dial.
- Automatic volume control that actually eliminates fading.
- Audio beat oscillator for quick finding of SW stations and code reception.
- Positive long life six-section coil switch selecting twelve different low loss coils and sixteen capacities at the turn of a knob.
- Tuned r.f. stage on all four bands.
- Two air tuned high gain i. f. stages, not one as in other sets of even higher price.
- Diode second detector for minimum distortion.
- Nine tuned circuits on all bands.
- Tone control for individual tone taste and noise reduction.
- Two audio stages.
- Push-pull Class A Prime distortionless ten watt power output stage.
- Twelve inch Jensen concert dynamic speaker.
- Fully shielded against outside pickup.
- Polished chromium chassis.
- Oversize transformers and condensers for long trouble-free life.
- Completely sealed and impregnated against tropic or arctic climates.
- Fully A.C. operated with no hum.
- Give the WORLD WIDE NINE a side by side test and watch it out-demonstrate any other set on every count—let it give you every day "stunt" reception you can't get on other sets.

● No matter what all wave set you buy you'll get twice as much radio in the new WORLD WIDE NINE —more than twice as many features as you can find in any all-wave receiver. The new WORLD WIDE NINE is the super-fine custom built MASTERPIECE II stripped for action and priced to fit every pocketbook. If you want volume to fill a cathedral, a hundred stations on the broadcast band, solid enjoyment of now easy to tune foreign short wave stations without the usual noise, the WORLD WIDE NINE is your answer.

Priced down to quantity production competition, the custom built WORLD WIDE NINE has as many features not possessed by any other radio as the MASTERPIECE II. It's positively the answer to the best buy in radio at a price anybody can afford. Order one now at the special July introductory price—try it for ten days, and if you're not absolutely convinced it's twice as much radio as you can get for its price, return it and get your money back. There's no risk—either you get twice as much radio as you expected or you don't buy it!

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☐ Kit 9 Matched Raytheon tubes	15.20	9.12
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